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FINAL PHASE II
FIELD OPERATIONS PLAN

VOLUME I OF II

CROYDON TCE SITE RI/FS
BUCKS COUNTY, PENNSYLVANIA

SEPTEMBER 1988

W.A. NO. 124-3LM7

EBASCO SERVICES INCORPORATED

160 Chubb Avenue. Lyndhurst. NJ 07071 · (201) 460-1900

EBASCO

September 27, 1988
RM/III/88-0600
N/A

Mr. Jeffrey B Winegar
U. S. Environmental Protection Agency
Region III
841 Chestnut Street
Philadelphia, PA 19107

Subject: REM III PROGRAM - EPA CONTRACT NO. 68-01-7250
CROYDON TCE SITE RI/FS, BUCKS COUNTY, PENNSYLVANIA
FINAL PHASE II FIELD OPERATIONS PLAN

Dear Mr. Winegar:

Enclosed are three (3) copies of the Final Phase II Field Operations Plan (FOP) for the Croydon TCE Site RI/FS. Volume I of the FOP consists of the Site Management Plan (SMP), the Field Sampling and Analysis Plan (FSAP), and the Health and Safety Plan (HASP). The appendices are contained in Volume II. Comments submitted by EPA have been addressed and incorporated into this report. Responses to these comments are provided in Attachment A.

If you have any questions or comments regarding this document, please feel free to contact me or our Site Manager, Mr. Raymond P Wattras, at 412-788-1080.

Very truly yours,

Richard C Evans, P.E.
Regional Manager, Region III

RCE/RPW/slk

Enclosures

cc: S Del Re - EPA, Region III (w/o attachment)
P Krantz-EPA, Central Regional Laboratory (w/attachment)
M Yates - ZPMO (w/attachment)
M Amdurer - ZPMO (w/attachment)
S Missailidis - ZPMO (w/attachment)
L Johnson - NUS (w/attachment)
R Wattras - NUS (w/attachment)
File: W.A. No. 124-3LM7 (621Y/551)
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ATTACHMENT A

RESPONSES TO EPA COMMENTS ON THE DRAFT
PHASE II FOP - CROYDON TCE SITE

Comment No. 1:

All project plans must be in document control format per requirements of QAMS 005/80.

Response:

The format utilized by the REM III Program has been acknowledged by EPA Region III as being acceptable.

Comment No. 2:

On page 5, third paragraph, the word "environmental" should be corrected to read "environment."

Response:

This has been corrected.

Comment No. 3:

In Table 3-1 on page 20, the word "asseess" should be corrected to read "access." In addition, in Table 3-2 on page 22, since the analyses of residential ground water and DNAPLs will include metals, Eh should be added to the field analyses of residential well water and DNAPLs, if possible. Also, on page 28, second paragraph, please change "Osborne Disposal Site" to read "Croydon TCE Site."

Response:

The typographical errors have been corrected. Eh has been added as an analytical parameter for only DNAPLs. Inorganic samples were already collected from the residential wells in March 1988 per EPA's request. These data were incorporated into the Phase I RI. The Phase II RI will only analyze selected residential wells for volatiles.

Comment No. 4:

A schedule and intended frequency for audits should be included. This also applies to lab activities.

Response:

Section 3.1.8 has been revised. Two field audits will be conducted. The first audit is usually performed during either the first or second week of sampling. A follow-up

audit will be conducted approximately one-half way through the field activities. CLP laboratories are audited by EPA. REM III laboratories are audited semiannually by Ebasco.

Comment No. 5:

The information in this section regarding the number of wells and their locations should be modified in accordance with recent discussions between NUS and EPA.

Response:

Section 3.2.1 has been revised to reflect these recent discussions.

Comment No. 6:

Due to the potential difficulty of removing drilling mud from the aquifer materials adjacent to the well screen, mud rotary is not an appropriate drilling method. Only air (with a filtered compressor) or potable water may be used to facilitate drilling.

Response:

Mud rotary drilling will not be performed. The preferred method is hollow-stem auger. Potable water may be used to facilitate drilling if necessary.

Comment No. 7:

Analysis of these materials (DNAPLs) should include the TICs for volatile, base-neutral and acid extractable organics and, if possible, field analysis for Eh.

Response:

DNAPL analyses will include an expanded list of TICs and field analysis of Eh.

Comment No. 8:

This section (Soil Gas) should be modified to reflect changes pursuant to recent NUS/EPA discussions.

Response:

Section 3.2.4.1 (Soil Gas Investigation) has been modified per NUS/EPA discussions. A 200-foot grid will be surveyed at Potential Source Area No. 1, as opposed to a 100-foot sampling grid. Additionally, a limited amount of soil gas sampling will be conducted at Potential Source Area No. 3b (Sherwood Refinishing Shop).

Comment No. 9:

Table 3-6 on page 62 appears to be inconsistent with Table 3-2 on page 22. The monitoring well samples identified as 3 in Table 3-6 should probably all have the superscript 2. The number of residential wells to be sampled and the associated field analyses to be completed are missing from Table 3-6. Additionally, Table 3-2 lists the residential wells to be sampled for nitrates and metals without the qualifier used in Table 3-6.

Response:

Table 3-6 has been deleted since it did not provide any new information that was not already available in Table 3-2. Because the resampling for nitrate and metal analyses was already conducted and incorporated into the Phase I RI, these analyses have been deleted from the Phase II RI.

Comment No. 10:

All references to plume origination from Potential Source Area No. 1 should be modified to include Potential Source Area No. 3.

Response:

Applicable sections of the FOP also include Potential Source Area No. 3, when referencing plume origination.

Comment No. 11:

All references to nitrates in residential wells should be eliminated based on the second nitrate analyses.

Response:

Applicable sections of the FOP have been modified per this comment.

Comment No. 12:

The Q/A reporting procedures should address the following items:

- Type and frequency of reporting
- Status of project (time table)
- Results of performance and system audits
- Data quality assessment
- Significant QA problems and proposed corrective action
- Changes in the QAPjP

Response:

Under the REM III Program, monthly progress reports are prepared for each project which identify the status of

the project with respect to budget, schedule, and technical achievements.

As outlined in Section 3.1.8 of the FOP, 2 field audits and a file audit will be conducted. A report of the audit findings is generated by the QA specialist and forwarded to the Site Manager for corrective action. This report is not a mandatory EPA deliverable.

Through the data validation process, an assessment is made with respect to the usability of the data. Section A.4.4.2 (Quality Control and Data Validation) of the Final Phase II RI/FS Work Plan describes the purpose and scope of the validation process.

A mechanism is in place for changes to the scope of the Work Plan and FOP. This is described in Section 3.1.9 (Procedures for Field Change and Corrective Action) of the FOP.

SEPTEMBER 1988

FINAL PHASE II
FIELD OPERATIONS PLAN

VOLUME I OF II

CROYDON TCE SITE RI/FS
BUCKS COUNTY, PENNSYLVANIA

EPA WORK ASSIGNMENT NUMBER 124-3LM7
UNDER
CONTRACT NUMBER 68-01-7250

PREPARED BY:
NUS CORPORATION
PITTSBURGH, PENNSYLVANIA

APPROVED BY:
EBASCO SERVICES INCORPORATED
LANGHORNE, PENNSYLVANIA

PREPARED BY:

RAYMOND P WATTRAS
SITE MANAGER
NUS CORPORATION

APPROVED BY:

RICHARD C EVANS, P.E.
REGIONAL MANAGER
EBASCO SERVICES INCORPORATED

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FIGURES

1.0 INTRODUCTION

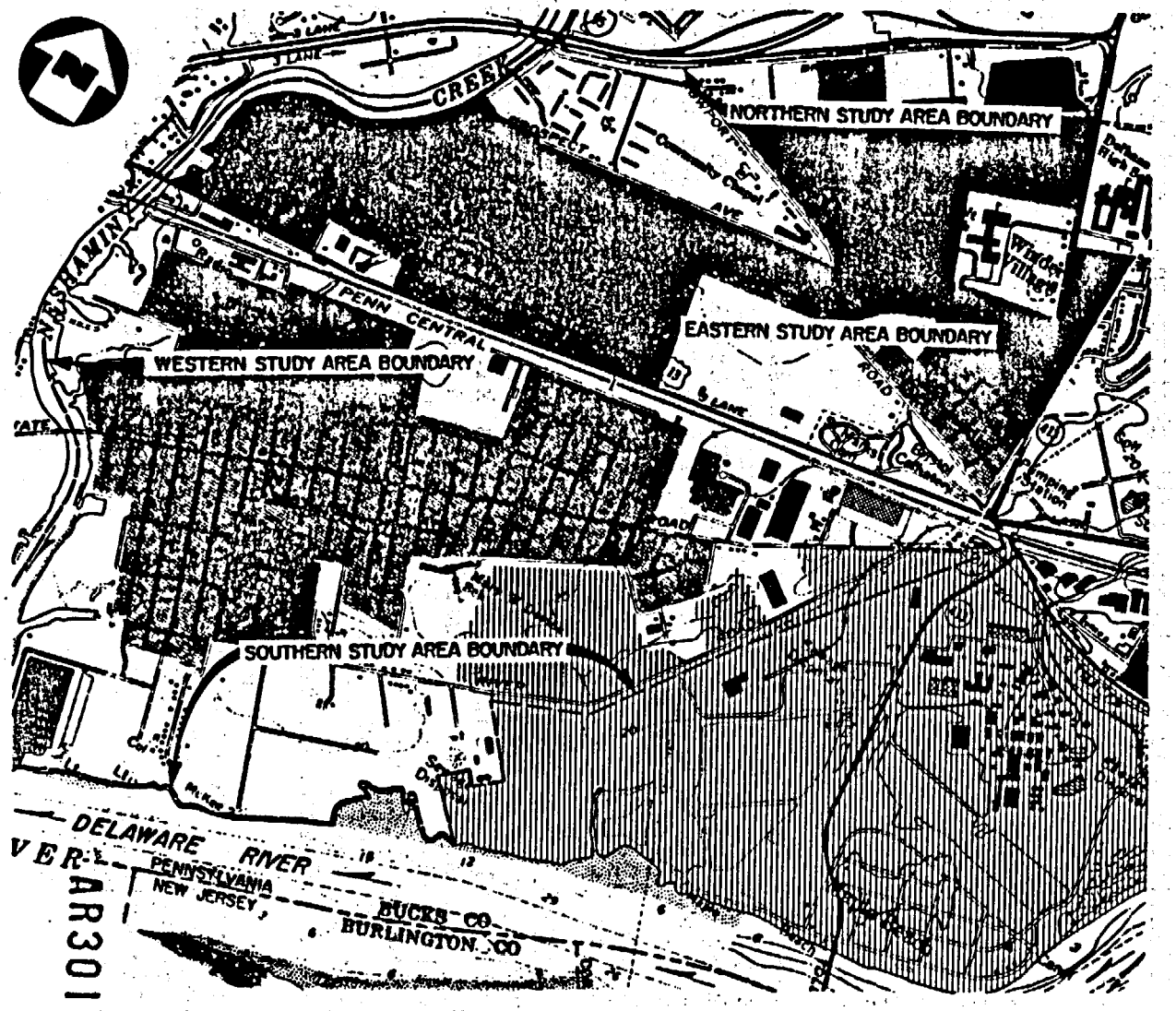
This Field Operations Plan (FOP) for the Croydon TCE Site, Bucks County, Pennsylvania, is an integral part of the Phase II Remedial Investigation/Feasibility Study (RI/FS) Work Plan. Whereas the work plan develops the RI/FS objectives, scope, and schedule, the FOP centers on the implementation of the sampling and analytical programs.

Section 2.0 of this FOP presents the Site Management Plan (SMP). This section will focus on site access, site security and control, and the responsibilities of the REM III Project Team. The Field Sampling and Analysis Plan (FSAP), which is described in Section 3.0, identifies the sampling and analytical objectives, detailed sampling procedures, and Quality Assurance/Quality Control (QA/QC) requirements for sample collection, handling, and shipping. Section 4.0 outlines the Health and Safety Plan (HASP). The HASP has been updated to reflect the Phase I analytical results and the Phase II scope of work.

1.1 SITE DESCRIPTION

The Croydon TCE Site is located in Bristol Township, Bucks County, Pennsylvania (see Figure 1-1). Analytical data collected prior to this investigation have revealed elevated levels of TCE and other organic and inorganic contaminants in the groundwater and surface water. The source of this contamination is unknown and therefore a "site" boundary was not established. However, a boundary for this investigation was established by EPA and will be referred to throughout this FOP as the "study area." The study area is bordered by Interstate 95 to the north, River Road and the Delaware River to the south, Neshaminy Creek to the west, and Route 413 to the east. This area encompasses approximately 3.5 square miles and is depicted in Figure 1-1.

South of River Road (outside of the study area) exists a large industrial landfill, which is owned by Rohm & Haas Company (Rohm & Haas) and Chemical Leaman Tank Line, Inc. (BCM, 1988). At present, the landfill is being studied by Rohm & Haas under a RCRA Corrective Action. The landfill was also studied by Rohm & Haas to determine if it was the source of the TCE groundwater contamination that is present in the southeastern portion of the study area (north of River Road). However, based on studies conducted to date by Rohm & Haas, TCE-contaminated groundwater is migrating toward the landfill area (i.e., southward toward the Delaware River) and not toward the study area (i.e., northward toward River Road). At this time, it appears that the source of the TCE contamination is not migrating from the Rohm & Haas Landfill. The landfill has not been included as part of the study area based on these findings. Data collected during the Phase I RI support Rohm & Haas' findings.



LEGEND

Study Area Boundary

Rohm and Haas Company Property

QUADRANGLE LOCATION

BASE MAP IS AN ENLARGEMENT OF A PORTION OF THE U.S.G.S. BEVERLY, PA-NJ QUADRANGLE (7.5 MINUTE SERIES, 1966, PHOTOREVISED 1973, CONTOUR INTERVAL 20 FEET) AND A PORTION OF THE BRISTOL, PA-NJ QUADRANGLE (7.5 MINUTE SERIES, 1955, PHOTOREVISED 1968, CONTOUR INTERVAL 20 FEET)

0 1000 2000 3000 4000

SCALE IN FEET

FIGURE 1-1

LOCATION MAP
CROYDON TCE SITE, BUCKS COUNTY, PA

NUS CORPORATION

The Rohm & Haas Company property extends just north of River Road, but no landfilling or waste dumping by Rohm & Haas is known to exist in this area. This area of the company property is mainly undeveloped and does not contain any Rohm & Haas manufacturing facilities. It is being studied as part of this RI/FS since groundwater beneath it is contaminated with TCE and other organic constituents.

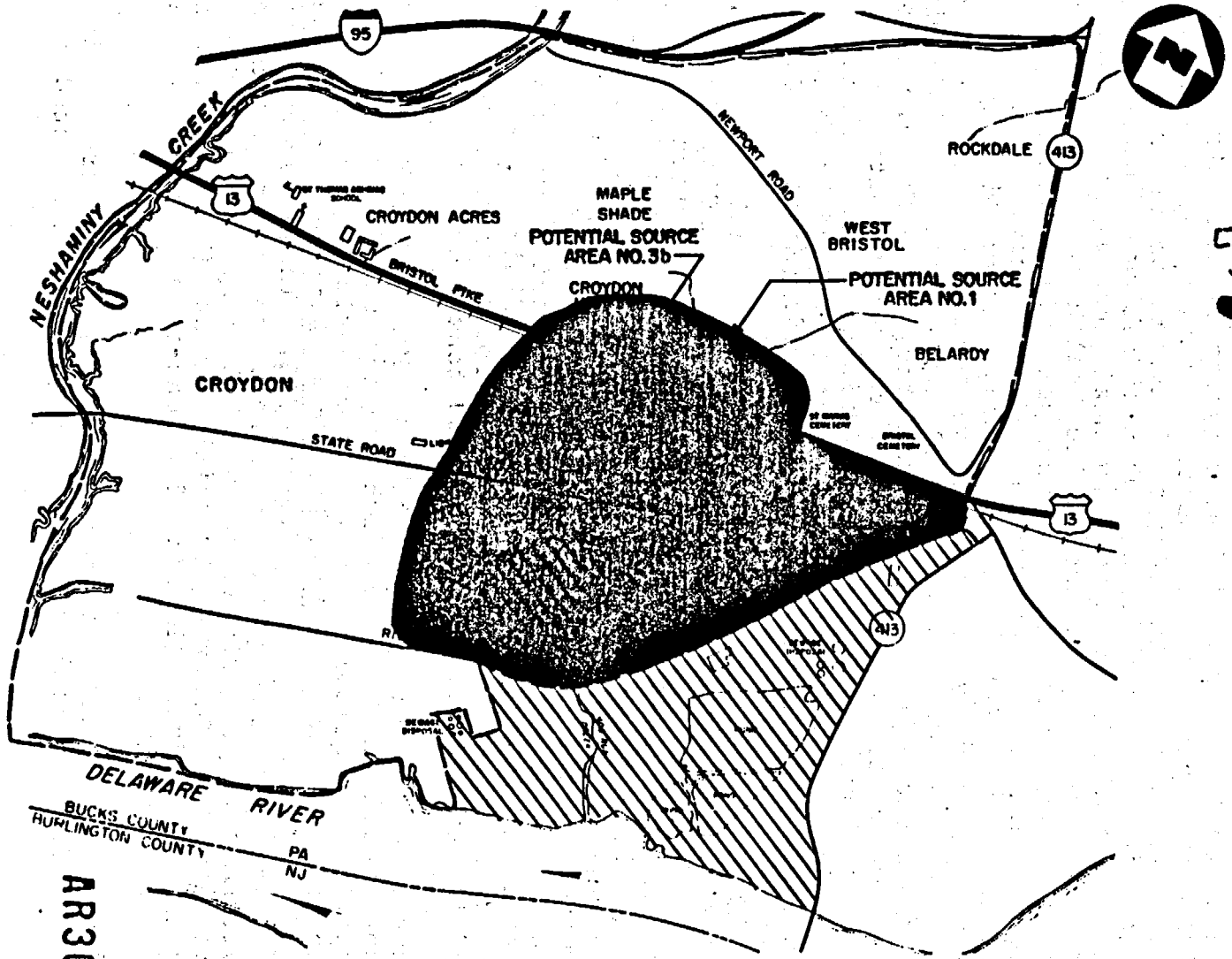
As shown in Figure 1-2, the area north of River Road to U.S. Route 13, extending east of the Mary Devine Elementary School and west of Route 413, was studied extensively during the Phase I RI and has been referred to as the "Focused Area of Investigation." This area was studied extensively because (1) groundwater beneath this area was known to be contaminated with TCE, (2) surface waters in this area were known to be contaminated, (3) ten potential source areas within this area were identified through historical photographs, and (4) several small- to large-scale industrial manufacturers were located in this area.

The focused area of investigation (see Figure 1-2) includes a portion of the Croydon residential community and an area where several large- to small-scale manufacturing and commercial establishments are located. This area covers about 1 square mile. Most of the commercial establishments are located along State Road and U.S. Route 13. The larger manufacturing facilities are located between these two roads in the southeastern portion of the focused area of investigation.

Hog Run Creek and its tributaries (i.e., East Branch and West Branch) are located within the focused area of investigation. The East and West Branches of Hog Run Creek emanate in the area between River Road and State Road and form Hog Run Creek just north of River Road (see Figure 1-2). Hog Run Creek then flows southward under River Road, between two Rohm & Haas landfills, and into the Delaware River.

As mentioned previously, the Mary Devine school is located at the westernmost portion of the focused area of investigation. Approximately 500 children in grades kindergarten through sixth grade attend this school. Rohm & Haas previously owned approximately 23 acres of the land, which the school and surrounding land now occupy. However, it has been reported that no dumping was done in this particular area (BCM, 1988). Several athletic fields, which are still owned by Rohm & Haas, are situated east of the elementary school.

For the most part, the remainder of the study area outside of the focused area of investigation is mainly residential. With the exception of commercial establishments along State Road and U.S. Route 13, there are few small-scale industrial manufacturing facilities outside of the focused area of investigation.



LEGEND

- Study Area Boundary
- Rohm and Haas Company Property
- Focused Area of Investigation

RESIDENTIAL AREAS

- Belardy
- Croydon
- Croydon Acres
- Croydon Heights
- Maple Shade
- Rockdale
- West Bristol

BUILDINGS

1. Nekoosa Packaging
2. Alpha Aromatics
3. Bristol Flare
4. Mack Warehouse
5. Coyne Chemical

0 1000 2000 3000 4000
SCALE IN FEET

FIGURE 1-2

GENERAL ARRANGEMENT
CROYDON TCE SITE, BUCKS COUNTY, PA

NUS CORPORATION

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Several residential communities, which were mainly constructed in the 1940s to 1960s, make up the study area. These communities include Croydon, Croydon Heights, Croydon Acres, Maple Shade, West Bristol, Belardy, and Rockdale. According to 1980 U.S. Census Bureau figures, approximately 67,500 people live in Bristol Township. Population figures are not available for the individual communities within the study area; however, it is estimated that the population within the study area could range from 2,000 to 3,000 people.

1.2 SITE HISTORY

The Croydon TCE Site was identified by EPA after a series of events led to a remedial investigation of the Rohm & Haas Site, which forms part of the southern boundary of the Croydon TCE Site study area. The series of events began in 1978 when a congressional investigating subcommittee was formed to examine the potential threats posed by hazardous waste disposal sites across the country to the public health and environment. The subcommittee requested waste disposal information from 53 of the largest chemical companies in the country. One of these companies, the Rohm & Haas Company, reported that hazardous wastes produced by the company were disposed on the company's property in Croydon, Bristol Township. Following a recommendation from the subcommittee, the EPA inspected the property in 1980 and discovered that groundwater and surface water on the site were contaminated by various organic compounds. In addition, groundwater contained heavy metals that exceeded federal drinking water standards (Ebasco, 1988).

In 1980, Congress passed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), better known as "Superfund." This act provided the state and federal governments with the authority to address abandoned or uncontrolled hazardous waste disposal sites and established a fund for remediating the sites once they were identified. As required by the new law, Rohm & Haas notified the EPA that the wastes disposed on its Bristol Township property included 43 tons of RCRA-hazardous waste by definition, or components listed as hazardous (BCM, 1988). Total process waste in the landfill is estimated to be 268,000 tons (BCM, 1988).

Subsequently, in 1983, Rohm & Haas hired BCM Eastern Incorporated (BCM) to conduct studies on its Bristol Township property. Following this investigation, BCM released two reports: Report on Landfill Investigation, April 1984, and Landfill Investigation, February 1985. These reports concluded that the property posed no threat to human health or the environment. Nevertheless, the EPA proposed the Rohm & Haas Site for the National Priorities List (NPL) in April 1985, thereby identifying the site for long-term remedial action under the Superfund law.

Under the REM III Program, BCM's reports were reviewed by Ebasco, Incorporated for EPA. A report was submitted to EPA in

November 1985 that identified some deficiencies in the BCM reports. However, it concurred with BCM's conclusions that suggested that a plume of contaminated groundwater emanates in Croydon and is migrating onto the Rohm & Haas property. Although the contaminant plume contains some compounds present in the Rohm & Haas landfill, particularly TCE, there was evidence to suggest that the Rohm & Haas Company was not responsible for this plume. Because the source of the contaminated plume was not identified and because many of the businesses in the area may also use compounds containing TCE, the EPA determined that a separate RI/FS was required to characterize the nature and extent of the contamination, assess the public and environmental health risks associated with it, and identify potential remedial alternatives.

In April 1985, the NUS Corporation Field Investigation Team (FIT) prepared a Hazard Ranking Score (HRS) for the Croydon TCE Site. An HRS of 31.60 was calculated. This score was based on the findings of the Rohm & Haas investigations, which included data for groundwater, surface water (Hog Run Creek), and sediments in the southeastern portion of the Croydon TCE study area. Because the source of contamination was unknown, a site boundary could not be established. In September 1985, the Croydon TCE Site was selected for inclusion on the National Priorities List (NPL) and ranked 616th.

1.3 PREVIOUS INVESTIGATIONS AND FINDINGS

The studies conducted prior to the Phase I RI were primarily focused on the southeastern portion of the study area (between River Road and State Road). Most of the sampling conducted in this area was performed by BCM in order to determine if TCE was migrating from or onto the Rohm & Haas property. These studies involved the construction and sampling of over 25 monitoring wells, surface water and sediment sampling of Hog Run Creek and its tributaries, residential well sampling, an aquatic survey of Hog Run Creek, and soil sampling near the Mary Devine Elementary School.

In October 1987, the REM III Team conducted a Phase I RI at the Croydon TCE Site. The Phase I RI objectives were as follows:

- Characterize the nature and extent of groundwater contamination detected within the southeastern portion of the study area (i.e., the focused area of investigation).
- Assess the public health and environmental risks posed by groundwater within the study area.

- Determine the quality of the local surface water in order to estimate the impact from groundwater discharge and estimate public health and environmental risks associated with the use of these waters.

- Identify potential source areas that may be contributing to the groundwater contamination which is present within the southeastern portion of the study area.

To meet these objectives, various field investigations were conducted to acquire the appropriate data. These studies included a hydrogeologic investigation, a residential well survey/investigation, and a surface water and sediment investigation. A limited amount of soil sampling was also undertaken in response to an EPA request. The request was made following a public meeting when a local resident indicated that fill material from the Rohm & Haas Landfill was placed throughout Croydon. Three separate areas were identified by the local resident.

The purpose of the hydrogeologic investigation was to (1) characterize the nature and extent of TCE groundwater contamination, which was previously detected in the southeastern portion of the study area and (2) to identify potential source areas that may be contributing to the groundwater contamination.

Twenty-nine wells were installed at 15 locations to monitor groundwater quality. Each well location, with the exception of location No. 10, consisted of a shallow (approximately 20-foot) and deep (approximately 50-foot) well. Location No. 10 was a deep well which was installed adjacent to an existing shallow well (LF-14-20). In-situ hydraulic conductivity tests (i.e., slug tests) were conducted on all 29 newly-installed wells (i.e., REM III wells) and 2 wells that were owned by Rohm & Haas. The 29 REM III wells and 17 existing wells were sampled and analyzed for Target Compound List (TCL) volatile organics. In addition to the volatile analysis, 10 selected wells were sampled and analyzed for base/neutral/acid (B/N/A) extractable organics, PCBs, pesticides, Target Analyte List (TAL) metals, cyanide, and water chemistry parameters (total organic carbon, biological oxygen demand, nitrates, nitrites, sulfates, total dissolved solids, total suspended solids, chlorides, carbonates, bicarbonates, and ammonia).

As part of the hydrogeologic investigation, 40 residential wells throughout the 3.5-square mile study area were also sampled. All of the wells were analyzed for TCL volatiles. Eight of the 40 wells were analyzed for B/N/A extractable organics, PCBs, pesticides, metals, cyanide, and water chemistry parameters. The eight wells were chosen to represent various portions of the study area.

The purpose of the Surface Water and Sediment Investigation was to determine the impact of groundwater discharge on the local surface waters in order to assess public health and

environmental risks. Samples were collected from Neshaminy Creek, the Delaware River, and Hog Run Creek and its tributaries. All surface water samples were analyzed for TCL organics, TAL metals, and cyanide. Sediment samples were analyzed for TCL volatiles and B/N/A extractable organics, TAL metals, and cyanide.

As previously mentioned, a local concerned citizen indicated during a public meeting that several areas in Croydon contained fill material from the Rohm & Haas landfill. These areas included the concerned citizen's yard, the ballfields adjacent to the Mary Devine Elementary School, and an area across from Rohm & Haas' Manufacturing Area B. EPA indicated that during the Phase I RI, soil samples would be collected from those areas suspected of containing fill material. Soil samples were collected from these areas and analyzed for TCL organics, TAL metals, and cyanide.

A summary of the nature and extent of contamination identified in groundwater, surface water, sediments, and soils within the Croydon TCE Site study area is provided below.

- A plume of contaminated groundwater was identified in the southeastern portion of the study area. The plume appears to originate from one or two potential areas north of U.S. Route 13 (Potential Source Areas No. 1 and No. 3b), and is migrating in the direction of regional groundwater flow (south-southeast). Trichloroethene and related compounds are the predominant contaminants.

- The occurrence and distribution of groundwater contamination suggests the possible presence of a second TCE plume originating from an offsite area east of Route 413. Localized groundwater flow is toward the northwest, opposite of the regional flow system in this area.

- A white, immiscible-liquid was observed during the purging of some of the monitoring wells. This liquid did not contain any recognizable odor, and was observed to be heavier than water. This liquid is a suspected Dense Non-Aqueous Phase Liquid (DNAPL). (Samples of the suspected DNAPL will be collected during the Phase II RI.)

- Lead was detected above health-based standards in one residential well. This compound appears to be unrelated to the the site. The presence of lead may be due to lead solder in the plumbing system.

- Surface waters and sediments in Hog Run Creek and the pond behind the VFW Post contain relatively low levels of volatile organic compounds (less than [illegible]). Groundwater discharge to these surface waters is considered the source of these compounds.

- Sediments within the study area contain polycyclic aromatic hydrocarbons (PAHs) and slightly elevated levels of several inorganic constituents. Based on the available data, these constituents may be unrelated to contamination associated with the site.

- Surface soil samples were obtained from three areas where fill material from the Rohm & Haas landfill was allegedly disposed. The samples contained PCBs, PAHs, and/or pesticides. Based on the available data, it is unknown whether these compounds are associated with the Rohm & Haas landfill, represent background levels, or are attributed to another potential contaminant source.

2

2.0 SITE MANAGEMENT PLAN

2.1 SITE CONTROL

2.1.1 Site Access

The Croydon TCE Site covers a 3.5-square mile area (referred to as the "study area") in Bristol Township, Bucks County, Pennsylvania. This study area is comprised of several residential communities and has an estimated population between 2,000-3,000 residents. Several small- to large-scale industries are also located within the study area. There are no physical features that would hamper site access; however, because the study area is mostly residential, property owners will have to be contacted prior to entering various properties.

Site access will be arranged prior to initiating the Phase II RI field activities. These activities include drilling and monitoring well installation, residential well sampling, surface water and sediment sampling, and soil sampling. Table 2-1 identifies the various property owners that will be affected during the Phase II field activities.

No REM III personnel shall enter the properties without first making their presence known to the property owners. Properties which are owned by various corporations (or businesses) will be contacted by the REM III Site Manager or designee, through the EPA Region III Regional Project Manager (RPM), to gain permission for site access. Anticipated field dates will be given to the appropriate corporate contacts (i.e., Works Manager, security guards). Additionally, homeowners who will have their residential wells sampled will be contacted by the SM or designee to obtain site access and arrange a suitable time for collecting the well sample.

In addition to notifying the property owners of the REM III Team's presence, no REM III Team member will enter the site until: (1) written or verbal authorization is received from the Site Manager or designee, (2) at least 24-hour notice is given to the RPM before initiation of field activities, and (3) each field team member possesses personal identification in the form of a driver's license, company identification card, or a suitable substitute approved by the Field Operations Leader (FOL). A list of persons authorized to enter the site will be provided to the RPM by the Site Manager or the FOL. The list is intended to prevent unauthorized persons from gaining site access. The list will be updated, as necessary, by the Site Manager or his designee. In gaining site access, no REM III Team member will sign or acknowledge any documents unless approved by the Site Manager. The Site Manager will contact the Ebasco RPM and EPA RPM prior to signing any document presented to a REM III Team member by a property owner.

TABLE 2-1

PROPERTY OWNERS - SITE ACCESS
CROYDON TCE SITE

Property Owners	Location	Remarks
Nekoosa Packaging	State Road, Croydon (parcel No. 5-54-16) Contact: Bill Waldron 788-7846	Sampling to be conducted at monitoring well locations Nos. 1, 5 and 6.
Coyne Chemical	State Road, Croydon (parcel No. 5-58-2-3) Contact: John Weirman 785-3000	Sampling to be conducted at monitoring well location No. 3.
Rohm & Haas Company	Croydon Contact: Bob Olarnic 785-8219	Sampling to be conducted at REM III monitoring well location Nos. 4, 8, 9, 10, 11, and 15, and Rohm & Haas wells.
Thomas Hartwell Trucking	U.S. Route 13 (parcel No. 5-13-236-1) Contact: Thomas Hartwell 788-9247	Proposed monitoring well location No. 17. Test borings.
M E Tryon*	U.S. Route 13 (parcel No. 5-13-236) Contact: Elizabeth Tryon	Sampling to be conducted at monitoring well location No. 13. Proposed monitoring well location No. 16. Test borings.
J Camerlingo	2009 Pennsylvania Avenue (parcel No. 5-13-237-3) 638-8433	Proposed monitoring well location No. 20.
R. Sherwood (Sherwood Refinishing)	Bristol Pike between Penn Street and Spring Street 788-6616	Proposed monitoring well location No. 19.
Bristol Homing Society c/o Walter Gosik	Buchanon Avenue (parcel No. 5-13-25) 639-5184	Proposed monitoring well location No. 18.

TABLE 2-1
PROPERTY OWNERS - SITE ACCESS
CROYDON TCE SITE
PAGE TWO

Property Owners	Location	Remarks
Bristol Lanes	U.S. Route 13 (parcel No. 5-58-1) Contact: Tony LaPolla 788-0453	Sampling to be conducted at monitoring well location No. 2.
Robert J Sabatini	Linton and Montgomery Avenue (parcel No. 5-12-77) Contact: Robert Sabatini 788-5571	Sampling to be conducted at monitoring well location No. 12.
Robert H and Dorothy Robinson**	State Road and Elm Street (parcel No. 5-54-49)	Sampling to be conducted at monitoring well location No. 7.
Ralph D Whitman, Sr.	2314 Brighton Avenue 785-1361	Proposed residential well sample.
Irene Grzeczkowski	914 Belleview Avenue 788-3425	Proposed residential well sample.
Francis and Elsie Clark	2401 Brighton Avenue 788-1316	Proposed residential well sample.
Alexander and Judith Johnson	922 Orchard Avenue 785-6455	Proposed residential well sample.
Harry C Brown	301 Elm Street 788-5060	Proposed residential well sample.
Hugh Templeton	204 Elm Avenue 788-9037	Proposed residential well sample.
Frank Hayden	1933 Bristol Pike 785-5386	Proposed residential well sample.
Barbara Higginson	611 Sixth Avenue 788-1009	Proposed residential well sample.
David Grafenstein	805 Girard Avenue 788-0129	Proposed residential well sample.

* M E Tryon resides at 619 Cedar Avenue, Croydon, Pennsylvania.
** Robert H and Dorothy Robinson reside in South Hampton, Pennsylvania.

2.1.2 Site Security/Control

All removable equipment will be returned to the command post and secured at the end of each work day. Any equipment (i.e., drilling rig) left on site will be secured to the extent possible to prevent unauthorized removal or vandalism. Any unfinished wells will be covered or capped in such a manner as to prevent tampering. Finished wells will be locked.

2.1.3 Field Office/Command Post

The field-office trailer was mobilized on site during the Phase I RI. This trailer is located near the Rohm & Haas biological treatment plant. The office trailer will serve as a central command post through the duration of the field investigation, providing communications, shelter, office space, sanitary facilities, and space for equipment storage and sample handling.

A key to unlock the entrance gate to the treatment plant will be given to the FOL. Rohm & Haas plant security will lock the gate after normal working hours. It will not be necessary to check-in to the plant security every time you enter their property; however, it is recommended that you call plant security from the office trailer at the start and finish of each working day. The telephone number is 215-785-8000. The office trailer telephone number is 785-8576.

2.2 SITE OPERATIONS

The following subsections outline the organization of the field team for the Croydon TCE Site Phase II Remedial Investigation (RI) field activities, the responsibilities of key personnel, and the schedule for performance of the RI field work.

2.2.1 Organization

The overall project organization and responsibilities of key management personnel are discussed in Section A.6.0 of the Phase II RI/FS Work Plan. The organizational chart presented in Section A.6.0 is reproduced as Figure 2-1 for easy reference.

Field work will be performed by a single team under the direction of the FOL. As shown in Figure 2-1, the FOL reports directly to the RI Task Manager. Figure 2-2 shows the field operations organization in greater detail. The FOL will be responsible for coordinating and overseeing all field activities and will interface with the Health and Safety Officer (HSO) in planning and performing the RI tasks. Each of the Field Team Leaders (FTLs) designated for the site RI activities will report to the FOL on a day-to-day basis. In accordance with the Health and Safety Plan (HASP), the HSO or his designee will interact with the field team members during performance of their tasks.

FIGURE 2-1

PROJECT ORGANIZATION
CROYDON TCE SITE

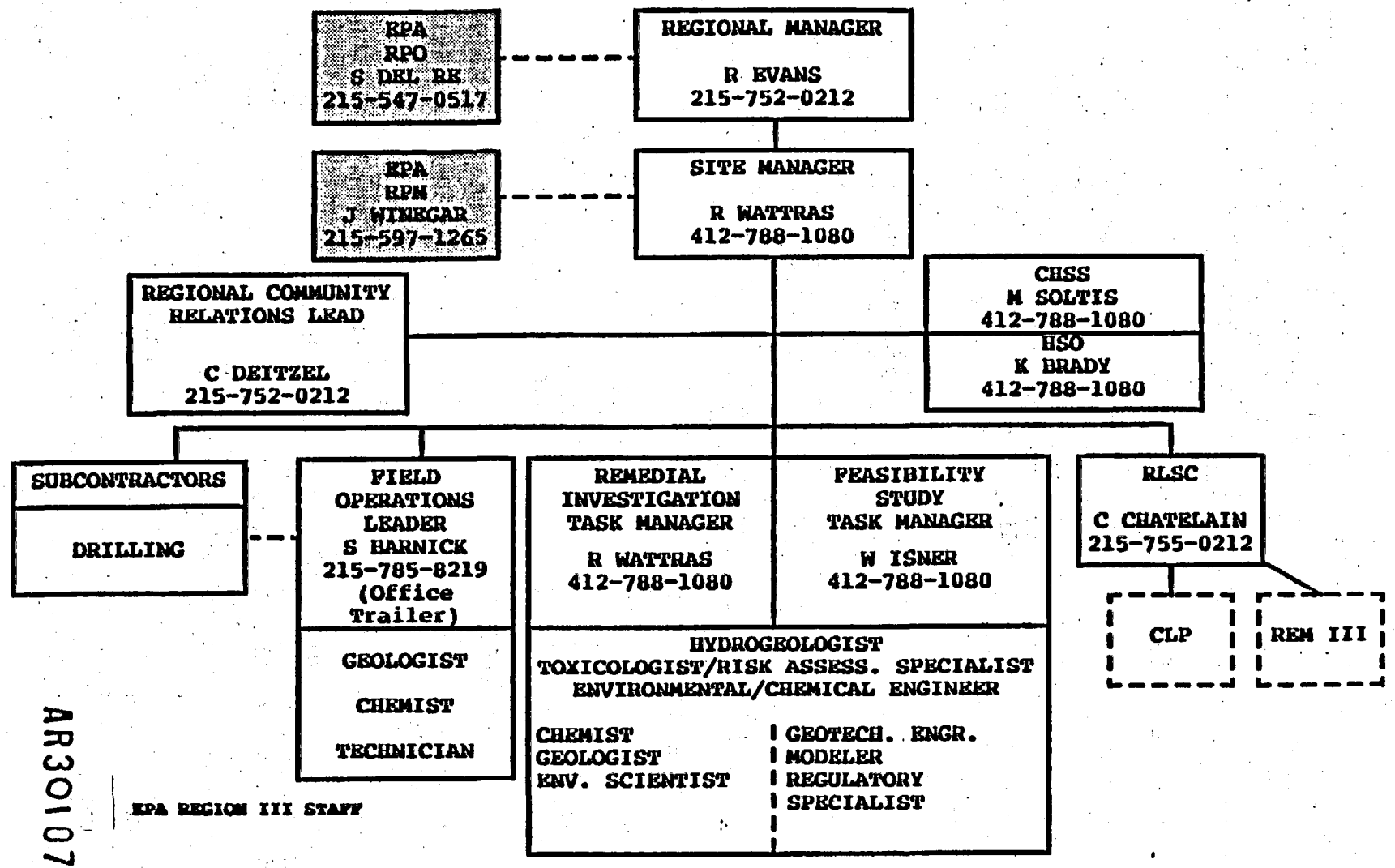
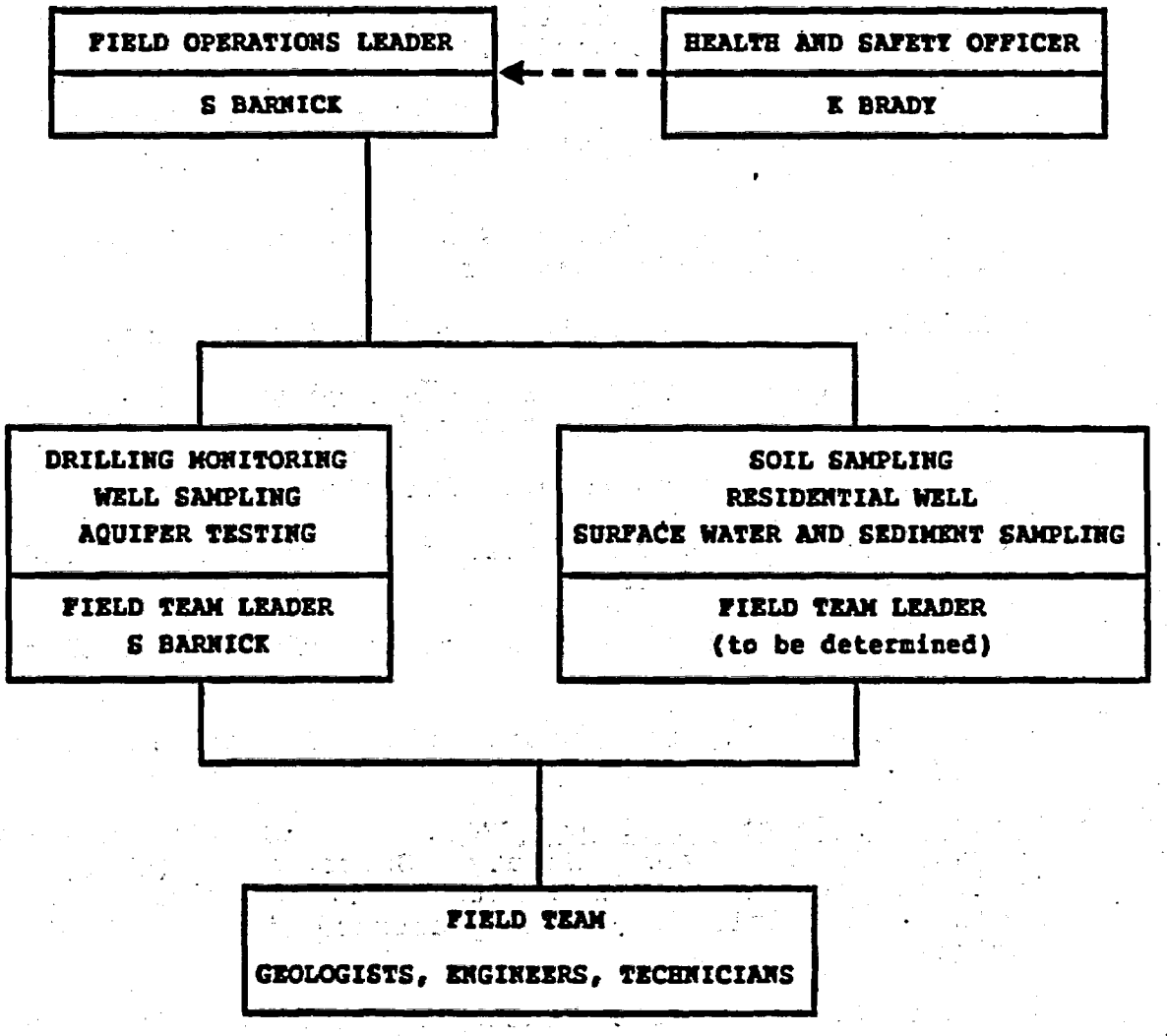


FIGURE 2-2

FIELD OPERATIONS TEAM
CROYDON TCE SITE



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2.2.2 Responsibilities of Key Personnel

Key personnel for field operations are identified in Figures 2-1 and 2-2. Their specific responsibilities are discussed below.

- Field Operations Leader (FOL). The FOL or designee is responsible for all day-to-day aspects of the Croydon TCE Site RI field work. The responsibilities of the FOL include:
  - Assuring that all field team members are familiar with the Field Sampling and Analysis Plan (FSAP) and HASP.
  - Assuring that all field team members have completed health and safety training.
  - Reporting to the RI Task Manager on a regular basis regarding the status of all field work and any problems encountered.
  - Completing Field Change Requests, as necessary, for approval by the Site Manager.
  - Coordinating the activities of all field teams.
- Field Team Leader (FTL). The FTL reports directly to the FOL and has the following responsibilities:
  - Providing team members with daily assignments.
  - Assuring that team members comply with the procedures outlined in the FSAP.
  - Coordinating with the FOL to ensure sample shipping schedules are met.
  - Reporting on a daily basis to the FOL on the progress of the team.
- Health and Safety Officer (HSO). The HSO reports to the Company Health and Safety Supervisor (CHSS) and indirectly to the FOL and Site Manager. Details of the HSO's responsibilities are presented in the HASP and include:
  - Controlling specific health and safety related field operations such as personnel decontamination, monitoring of worker heat or cold stress, distribution of safety equipment, etc.
  - Assuring that field team personnel comply with all procedures established by the HASP.

- Identifying assistant HSOs or HSO designees.
- Terminating work if an imminent safety hazard, emergency situation, or other potentially dangerous situation is encountered.

• Regional Laboratory Sample Coordinator (RLSC). The RLSC is responsible for the following:

- Scheduling laboratory service through SMO and other vendors.
- Tracking samples and coordinating with EPA CRL.
- Scheduling data validation.
- Identifying laboratory analytical methods and laboratory QC.

2.3 SCHEDULE

The schedule for the Croydon TCE Site Phase II RI field activities is presented in Section A.6.3 of the Phase II RI/FS Work Plan. Key target dates are:

Activity	Anticipated Dates	
	Start	End
Mobilization*	9/26	10/7
Drilling and Monitoring Well Construction (includes aquifer testing)	10/10	10/28
Survey Grid	10/10	10/14
Soil Gas Investigation	10/17	10/28
Soil Sampling (surface and test borings)	10/31	11/11
Groundwater Sampling (residential wells)	11/14	11/18
Surface Water and Sediment Sampling	11/14	11/18
Groundwater Sampling (Rohm & Haas and REM III wells)	11/21	12/9
Survey Sampling Locations	11/14	11/18
Demobilization	12/9	12/16

* Includes obtaining site access

3

3.0 FIELD SAMPLING AND ANALYSIS PLAN (FSAP)

3.1 GENERAL FIELD OPERATIONS

3.1.1 Data Quality Objectives and PARCC Parameters

The Phase II RI/FS Work Plan for the Croydon TCE Site summarized available data, defined the Phase II RI/FS objectives, and identified the data required to meet the objectives. The Phase II RI/FS objectives are given in Table 3-1, along with the criteria and data gathering activities needed to meet the objectives.

This section of the FSAP outlines the data quality factors needed to meet the objectives described in Table 3-1. DQOs are established to ensure that the data collected are sufficient and of adequate quantity and quality for their intended uses (USEPA, 1987). Table 3-2 summarizes the sampling and analysis program for the Phase II field activities. Included in this table are the objectives of each sample and the analytical methods which are needed to meet the objectives.

The analytical methods selected for risk characterization (see data objectives column in Table 3-2) were based on the precision and accuracy of the methods. Additionally, the detection limits are consistent with risk assessment requirements and ARARs. For the engineering and site characterization needs, the precision, accuracy, and detection limits of the analytical method are sufficient.

In general, a four-step methodology was used to develop site-specific Data Quality Objectives (DQOs), identify appropriate analytical protocols, and establish Precision, Accuracy, Representativeness, Comparability, and Completeness (PARCC) requirements for each data set. This four-step approach included the following components.

- Comparison of Applicable, or Relevant and Appropriate Requirements (ARARs), risk-based criteria, data needs for risk, engineering, and modeling purposes to detection limits for available analytical methods.
- Selection of appropriate methods to allow quantification of parameters at levels sufficiently below ARARs, etc., to minimize number of critical data points.
- Evaluation of maximum allowable variability (i.e., maximum precision and accuracy range) based on a comparison of the detection limit to ARARs, etc.
- Development of a site-specific acceptable variability, based on proposed data uses and method-specific precision and accuracy information.

TABLE 3-1

CRITERIA FOR MEETING THE PHASE II RI/FS OBJECTIVES
CROYDON TCE SITE

RI Objectives	Criteria for Meeting Objectives	Data Collection Activities
1) Investigate Potential Source Areas No. 1 and 3b to determine whether contaminated soils are contributing to the groundwater contamination at the site.	• Assess soil contamination at these potential source areas.	• Conduct soil gas sampling at Potential Source Areas No. 1 and No. 3b. • Auger soil borings where soil contamination is suspected, based on the results of the soil gas investigation. Analyze soil samples for TCL and TAL constituents.
2) Define the northern boundary of the TCE groundwater plume.	• Determine aquifer characteristics north of U.S. Route 13. • Evaluate the hydrogeology of the area just north of U.S. Route 13 to State Road. • Determine the presence or absence of TCE in groundwater upgradient and downgradient from Potential Source Areas No. 1 and No. 3b.	• Install monitoring wells north and south of Potential Source Areas No. 1 and No. 3b. • Collect groundwater samples and analyze the samples for TCL volatile organics. • Obtain water level measurements from newly-installed wells.

TABLE 3-1
CRITERIA FOR MEETING THE PHASE II RI/FS OBJECTIVES
CROYDON TCE SITE
PAGE TWO

RI Objectives	Criteria for Meeting Objectives	Data Collection Activities
3) Characterize the hydrogeology and extent of groundwater contamination in the focused area of investigation.	• Confirm the presence or absence of TCE contamination in existing REM III/Rohm & Haas monitoring wells, newly-installed REM III wells, and in selected Rohm & Haas wells south of River Road. • Confirm groundwater flow rates and direction. • Investigate immiscible liquid detected during the Phase I RI.	• Sample all Phase I and Phase II monitoring wells and selected Rohm & Haas monitoring wells south of River Road. Analyze the samples for TCL volatile organics. • Conduct hydrogeologic testing of all newly-installed monitoring wells. • Obtain water level measurements from all monitoring wells and staff gauges. • Sample immiscible liquid and analyze for TCL and TAL constituents.
4) Confirm public health risks posed by the use of groundwater within the study area.	• Assess groundwater quality of selected domestic well users.	• Sample all residential wells within the focused area of investigation which exhibited elevated levels of TCE, lead or nitrate. Analyze the samples for TCL volatile organics, TAL inorganics and/or nitrate • Sample selected residential wells outside of the focused area of investigation to confirm Phase I results.

TABLE 3-1
CRITERIA FOR MEETING THE PHASE II RI/FS OBJECTIVES
CROYDON TCE SITE
PAGE THREE

RI Objectives	Criteria for Meeting Objectives	Data Collection Activities
5) Confirm the presence or absence of PCBs, PAHs, and pesticides in soils.	• Resample 3 areas where contaminants (PCBs and PAHs) were detected during the Phase I RI. • Determine background level of PCBs and PAHs in soils. • Determine presence or absence of contaminants PCBs and PAHs in the Rohm & Haas landfill.	• Collect soil samples from the 3 previously sampled areas, the Rohm & Haas Landfill, and background area. Analyze the samples for PCBs, PAHs, and pesticides.
6) Define the quality of surface waters and sediments in the Delaware River and the drainage creek located north of U.S. Route 13 and estimate health risks associated with use of these waters.	• Determine surface water and sediment quailty.	• Collect surface water and sediment samples from the Delaware River and the drainage creek. Analyze the surface water samples for TCL volatile organics. Analyze the sediment samples for TCL organic constituents.

TABLE 3-2

SUMMARY OF PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS
CROYDON TCE SITE

Matrix - Groundwater (Monitoring Wells)

No. of Samples	No. of Duplicates	No. of Bottle Blanks	No. of Equip. Rinsate Blanks	No. of Trip Blanks	Total No. of Samples	Data(a) Use Objective	Analy. Option	Analysis	Source of Analysis	Analytical Method(b)	Bottle Requirements		Holding Time	Preservation Requirements
											Per Sample	Total		
68	3	3	3	15	84	1,2,3,4	V	TCL Volatiles(c)	CLP-SAS	EPA Method 601/602	4, 40-ml glass vials	336	7 days	Cool to 4°C
68	-	-	-	-	68	1,3,4	I	pH, Temperature, DO, and Specific Conductance	Field Analysis	Primary specific Ion Exchange	-	-	-	-

Matrix - Suspected Dense Non-Aqueous Phase Liquid (DNAPL)

3	1	-	-	-	4	1,2,3,4	V	TCL Volatiles(d)	CLP-SAS	CLP Protocol	4, 40-ml glass vials	16	7 days	None
3	1	-	-	-	4	1,2,3,4	V	TCL B/N/A(d) Pesticides/PCBs	CLP-SAS	CLP Protocol	1, 8-oz wide-mouth jar	4	7 days until extraction; 40 days until analysis	None
3	1	1	1		6	1,2,3,4	V	TAL Metals and Cyanide(d)	CLP-SAS	CLP Protocol	1, 8-oz wide-mouth jar	6	6 months; Hg - 28 days	None
3	1	-	-	-	4	4,3,1	III	TOC(d)	CLP-SAS	EPA 415.1	1, 1-liter plastic	4	28 days	None
3	-	-	-	-	3	1,3,4	I	pH, Eh, Temperature, DO, and Specific Conductance	Field Analysis	Primary Specific Ion Electrode	-	-	-	-

Matrix - Groundwater (Residential Wells)

9	2	1	-	2	14	1,2,3,4	V	TCL Volatiles(e)	CLP-SAS	EPA Method 601/602	4, 40-ml glass vials	56	7 days	Cool to 4°C
9	-	-	-	-	9	1,3,4	I	pH, DO, Temperature, and Specific Conductance	Field Analysis	Specific Ion Electrode	-	-	-	-

TABLE 3-2
SUMMARY OF PHASE II SAMPLING AND ANALYTICAL REQUIREMENTS
CROYDON TCE SITE
PAGE TWO

Matrix - Surface and Shallow Soils (Alleged Landfill Dumping Areas)

No. of Samples	No. of Duplicates	No. of Bottle Blanks	No. of Equip. Rinsate Blanks	No. of Trip Blanks	Total No. of Samples	Data(a) Use Objective	Analy. Option	Analysis	Source of Analysis	Analytical Method(b)	Bottle Requirements		Holding Time	Preservation Requirements
											Per Sample	Total		
14	1	1	1	-	17	1,2,3,4	IV	TCL B/N/A, PCBs, Pesticides	CLP-RAS	CLP Protocol	1, 8-oz wide-mouth jar	17	7 days to extraction; 40 days until analysis	Cool to 4°C

Matrix - Surface and Shallow Soils (Sherwood Refinishing Shop)

8	1	1	1	1	12	1,2,3,4	IV	TCL Volatiles	CLP-RAS	CLP Protocol	2, 40-ml glass vial	24	7 days	Cool to 4°C
4	-	-	-	-	4	3, 4	III	Percent Ash	REM III-SAS	ASTM D2974-84 Vol. 04.08	2, 16-oz wide-mouth glass	8	None	None
4	-	-	-	-	4	2, 3, 4	III	BTU Content	REM III-SAS	ASTM D3286-85	2, 16-oz wide-mouth glass	8	None	None
4	1	0	0	0	5	3, 4	III	TOC	REM III-SAS	(j)	1, 8-oz wide-mouth glass	5	None	None

Matrix - Subsurface Soils

45	3	3	3	10	64	1,2,3,4	IV	TCL Volatiles	CLP-RAS	CLP Protocol	2, 40-ml glass	128	7 days	Cool to 4°C
45	3	3	3	-	54	1,2,3,4	IV	TCL B/N/A, PCB, Pesticides	CLP-RAS	CLP Protocol	8-oz wide-mouth jar	54	7 days to extraction; 40 days to analysis	Cool to 4°C
45	3	3	3	-	54	1,2,3,4	IV	TAL Metals and Cyanide	CLP-RAS	CLP Protocol	8-oz wide-mouth jar	54	6 months CN - 14 days Hg - 28 days	Cool to 4°C
12	1	-	-	-	13	2,3,1	III	pH	REM III-SAS	SW 846-9045	4-oz wide-mouth glass	13	None	None
12	1	-	-	-	13	2,3,4	III	BTU	REM III SAS	ASTM D3286-85	2, 16-oz wide-mouth glass	26	None	None

TABLE 3-2
SUMMARY OF PHASE II FIELD SAMPLING AND ANALYTICAL REQUIREMENTS
CROYDON TCE SITE
PAGE THREE

Matrix - Subsurface Soils (CONTINUED)

No. of Samples	No. of Duplicates	No. of Bottle Blanks	No. of Equip. Rinsate Blanks	No. of Trip Blanks	Total No. of Samples	Data(a) Use Objective	Analy. Option	Analysis	Source of Analysis	Analytical Method(b)	Bottle Requirements		Holding Time	Preservation Requirements
											Per Sample	Total		
12	1	-	-	-	13	2,3,4	III	Percent Ash	REM III SAS	ASTM D2974-84 Vol. 04.08	2, 16-oz wide-mouth glass	26	None	None
12	1	-	-	-	13	2,3,4	III	Grain Size	REM III SAS	ASTM D422-63	2, 16-oz wide-mouth glass	26	None	None
12	1	-	-	-	13	2,3,4	III	CEC	REM III-SAS	SW846-9081	2, 16-oz wide-mouth glass	26	None	None
12	1	-	-	-	13	3,4	III	Moisture Content	REM III-SAS	ASTM D2216-80	2, 16-oz wide-mouth glass	26	None	None
12	1	-	-	-	13	3,4	III	Nitrogen/ Phosphorous	REM III-SAS	(e)(f)	1, 4-oz wide-mouth glass	13	Phosporous - 7 days	Cool to 4°C
12	1	-	-	-	13	3,4	III	TOC	REM III-SAS	(j)	1, 8-oz wide-mouth glass	13	None	None
12	1	-	-	-	13	3,4	III	COD, BOD	REM III-SAS	(g)(h)	1, 4-oz wide-mouth glass	13	None	None

Matrix - Sediment

7	1	1	1	1	11	1,2,3,4	IV	TCL Volatiles	CLP-RAS	CLP Protocol	2, 40-ml glass	22	7 days	Cool to 4°C
7	1	1	1	-	10	1,2,3,4	IV	TCL B/N/A, PCBs, Pesticides	CLP-RAS	CLP Protocol	1, 8-oz wide-mouth jar	10	7 days to extraction; 40 days to analysis	Cool to 4°C
7	1	1	1	-	10	1,2,3,4	IV	TAL Metals and Cyanide	CLP-RAS	CLP Protocol	1, 8-oz wide-mouth jar	10	6 months; CN - 14 days Hg - 28 days	Cool to 4°C
7	1	-	-	-	8	3,4	III	TOC	REM III-SAS	(j)	1, 8 oz wide-mouth glass	8	None	None
7	-	-	-	-	7	2,3,4	III	Grain Size	REM III-SAS	ASTM D422-63	2, 16 oz wide-mouth glass	14	None	None

TABLE 3-2
SUMMARY OF PHASE II FIELD SAMPLING AND ANALYTICAL REQUIREMENTS
CROYDON TCE SITE
PAGE FOUR

Matrix - Surface Water

No. of Samples	No. of Duplicates	No. of Bottle Blanks	No. of Equip. Rinsate Blanks	No. of Trip Blanks	Total No. of Samples	Data(a) Use Objective	Analy. Option	Analysis	Source of Analysis	Analytical Method(b)	Bottle Requirements		Holding Time	Preservation Requirements
											Per Sample	Total		
7	1	1	1	1	11	1,2,3,4	V	TCL Volatiles(c)	CLP-SAS	EPA Method 601/602	4, 40-ml glass vials	44	7 days	Cool to 4°C
7	-	-	-	-	7	1,3,4	I	pH, DO, Temperature, and Specific Conductance	Field analysis	Primary Specific Ion Electrode	-	-	-	-
7	1	-	-	-	8	4,3,1	III	TSS	REM III-SAS	EPA 160.2	1, 1-liter plastic	8	48 hours	Cool to 4° C
7	1	-	-	-	8	4,3,1	III	Total Alkalinity	REM III-SAS	EPA 310.1	1, 1-liter plastic	8	14 days	Cool to 4° C

(a) Includes prioritization of data uses; (1) Site characterization (2) Risk Assessment (3) Evaluation of Alternatives (4) Engineering Design of Alternatives.
(b) Analytical sensitivity achieved by the proposed analytical method is acceptable for the objectives and analyses. The methods presented were selected because the precision, accuracy, and detection limits of the method are suitable for the intended data use.
(c) Analysis by nonstandard methods.
(d) Samples to be submitted as high concentration samples.
(e) Total Kjeldahl nitrogen - page 3-201 and nitrite-nitrate, page 3-183, from "Procedures for Handling and Chemical Analysis of Sediment and Water Samples, EPA, May 1981.
(f) Total Phosphates - page 3-227 from "Procedures for Handling and Chemical Analysis of Sediment and Water Samples, EPA, May 1981.
(g) Page 3-393 from "Procedures for Handling and Chemical Analysis of Sediment and Water Samples," EPA, May 1981.
(h) Page 3-388 from "Procedures for Handling and Chemical Analysis of Sediment and Water Samples," EPA, May 1981.
(j) Page 3-73 from "Procedures for Handling and Chemical Analysis of Sediment and Water Samples," EPA, May 1981.

TABLE 3-2
SUMMARY OF PHASE II FIELD SAMPLING AND ANALYTICAL REQUIREMENTS
CROYDON TCE SITE
PAGE FIVE

NA	Not Applicable
CLP	Contract Laboratory Program
CLP Protocol	Protocols defined in the CLP Statement of Work
SW	Test Methods for Evaluating Solid Waste (SW-846)
SM	Standard Methods for the Examination of Water and Wastewater
TAL	Target Analyte List
TCL	Target Compound List (Formerly the HSL)
DO	Dissolved Oxygen Content
TOC	Total Organic Carbon
TSS	Total Suspended Solids
CEC	Cation Exchange Capacity
CLP-SAS	Special Analytical Services (SAS) requiring specified preparation, analysis or reporting techniques which are available through the CLP. CLP-SAS requires coordination with SMO.
Bottle Blank	Samples which are obtained by directly pouring analyte-free, deionized water into a sample collection bottle. They serve as an oversight funciton in assuring the effect of residual contamination in the sample collector bottle.
Field Duplicate	A single sample split into two portions and both are submitted blindly to the laboratory. They serve as an oversight function in assessing both sampling and analytical QA/QC.
Trip Blank	Trip blanks are prepared prior to the sampling event in the actual sample containers and are kept with the investigation samples throughout the sampling event. Trip blanks must be submitted with each batch (i.e., daily) of samples submitted for VOA analysis.
Equipment Rinsate Blank	Samples which are obtained by running analyte-free deionized water through sample collection equipment (bailer, pump, auger, etc.) after decontamination. These samples are used to monitor the effectiveness of equipment decontamination procedures.

This acceptable variability, or precision and accuracy "window," was compared to historical laboratory performance data on a method-by-method basis (Appendix A). This comparison enabled the determination of whether site-specific goals were attainable within the standard Contract Laboratory Program (CLP) framework, or whether more stringent precision and accuracy requirements will be needed (e.g., additional matrix spikes, etc.).

PARCC parameters were reviewed as part of the DQO process. PARCC parameters are indicators of data quality. The objectives of the RI/FS and intended end use of the data needed to meet the objectives define the PARCC parameters. The following outlines the PARCC goals as they relate to the Croydon TCE Site.

- Precision and Accuracy Goals

  Field and laboratory precision and accuracy performance can affect the attainment of project objectives. This is particularly the case when decisions regarding compliance with established criteria will be made based upon laboratory analysis of field samples. Such criteria comparisons are common to risk assessment and to remediation alternative screening. Given the uncertainties associated with the estimation of health effects and contaminant transport modeling, the following overall precision and accuracy goals have been identified as necessary to meet the project objectives:

  Precision ±50 percent
  Accuracy ±50 percent

  Historical laboratory precision and accuracy data were reviewed in order to select analytical method suitable for the intended data uses. The analytical methods presented in Table 3-2 were selected because the precision and accuracy of these methods are suitable for risk assessment and/or engineering evaluations for the Croydon TCE Site. Appendix A presents a compilation of the available precision and accuracy data for these methods.

  Analytical precision and accuracy will be evaluated following receipt of the laboratory data. Analytical accuracy will be measured as percent recovery from matrix and surrogate spike samples. Analytical precision will be measured as the relative standard deviation from laboratory internal duplicates.

  Overall sampling and analytical precision and accuracy will be determined using the same rationale from blind field duplicates and laboratory internal QC data.

  Field sampling precision and accuracy is not readily amenable to objective measurement. Some estimate can be inferred by contrasting the overall precision and

accuracy estimates obtained from field duplicates with internal laboratory precision and accuracy estimates.

Field contamination, sample preservation, and sample handling may also affect precision and accuracy. To assure minimization of precision and accuracy errors associated with field activities, field sampling will be conducted in accordance with the REM III Program Field Technical Guidelines and other (EPA) guidelines. Any deviation from standard sampling procedures must be duly noted by the sampling team to ensure correct assessment of the data obtained from the sample in question.

It should be noted that no project resources will be expended to develop precision and accuracy data for method (field or analytical) validation, except those commonly applied in the CERCLA program for collection of routine QA/QC data. Routine QA/QC data will include analyses from field duplicates, field blanks, equipment rinsate blanks and trip blanks, based on the existing guidance which specifies the type and proportion of samples submitted for QA/QC (USEPA, 1987).

An assessment of data validity (i.e., 95 percent confidence limit) with respect to the intended use will be conducted based on laboratory supplied QA/QC data and protocols routinely employed for validation of CLP Routine Analytical Services (RAS) and Special Analytical Services (SAS) analytical results. In general, results which are rejected by the validation process will be disqualified for application to the intended use. Qualified data, which are defensible, will be used to the most practical extent.

- Representativeness

Sections A.4.3 and A.4.4 of the Phase II RI/FS Work Plan details the site sampling program and rationale for sampling locations. The sampling program outlined in Section A.4.4 is designed to ensure the analytical data obtained during the Phase II RI represent conditions found at the site. Sample locations were selected to ensure soil, groundwater, surface water, and sediment analytical data are suitable for the intended use and adequately characterize the site. A sufficient number of samples will be obtained to insure site conditions are adequately assessed.

In addition to the sampling program, sampling techniques may also affect representativeness. All sampling efforts will be conducted using procedures designed to maximize the goal that the sample be representative of the media from which it was taken. To ensure data represents site conditions, standard sampling procedures will be followed.

Section 3.2 provides details on the technical guidelines and procedures to be used by the field personnel for conducting the RI in order to collect samples which represent actual site conditions. For example, groundwater samples will be obtained from wells only after the well has been purged of three to five well volumes to ensure that standing water is removed and that the samples are representative of aquifer water quality. Surface water and sediment samples will be collected from the intermittent streams beginning from the downstream reach and proceeding upstream. Surface water samples will be obtained before the corresponding sediment sample to prevent undue disturbance to the sediment and possible introduction of contamination into the water sample.

- Completeness

The sampling and analysis program for the site is sufficiently broad in scope to prevent a single data point (or parameter) from sacrificing attainment of the RI/FS objectives. Each medium is critical to the assessment of the site. Consequently, there exists some critical data requirements below which the objectives of the study will be compromised. On a media-by-media case, the data requirements for attainment of project objectives is approximately 70-80 percent completeness.

It is recognized that critical data points may not be identified until the analytical results are evaluated. Additionally, several sampling points, in aggregate, may be considered critical either by location or by analysis to the project goals.

- Comparability

One of the objectives of the RI is to ensure analytical data are of comparable quality both between sample locations and with data obtained in previous studies of the site. The data collection mechanisms proposed are designed to produce comparable data. To ensure comparable data, standard recognized field and analytical methodologies will be followed. Section 3.2 provides details on the technical guidelines and procedures to be used by the field personnel for conducting the field activities.

To ensure comparability between samples over time, consideration will be given to seasonal conditions, flow, or other environmental factors that may influence the analytical results. For example, all groundwater and surface water samples will be collected during the same time period to reduce the variability associated with environmental conditions.

Data will be reduced, reported, and documented in a consistent manner throughout the study. For example, water and sediment quality data will be reported using a consistent set of units throughout the study. Any deviations from established protocols will be noted in the data base so that data comparability can be maintained.

3.1.2 Field Technical Guidelines

The basic requirement for all work conducted under the REM III Program is that the data collected must maintain consistency and good quality. Data must be precise, accurate, representative, complete, and comparable. To meet these requirements and the DQOs, site activities will refer to the guidance of Ebasco's Field Technical Guidelines (FTGs), comments on the field technical guidelines from the EPA quality assurance section, Health and Safety Guidelines (HSG), and Administrative Guidelines. These guidelines, developed for the REM III program, are intended to provide general technical guidance for project activities. A list of applicable guidelines for the Croydon TCE Site appears below:

FT-6.01 Soil and Rock Borings
FT-6.02 Borehole and Sample Logging
FT-6.03 Decontamination of Drilling Rig and Sampling Equipment
FT-6.05 Aquifer Pump Testing
FT-6.06 In-Situ Hydraulic Conductivity Testing
FT-6.07 Piezometric Head Measurement and Groundwater Contour Mapping
FT-7.01 Groundwater Monitoring Point Installation
FT-7.02 Groundwater Sample Acquisition
FT-7.03 Soil and Rock Sample Acquisition
FT-7.04 Management of Sampling and Preparation of Required Forms
FT-7.05 Sample Identification and Chain-of-Custody
FT-7.06 Sample Preservation
FT-7.07 Sample Packaging and Shipping
FT-7.08 Surface Water and Sediment Sampling
FT-7.09 Soil Sampling in Test Pits and Trenches
FT-7.10 On-Site Water Quality Testing
FT-12.01 Decontamination of Chemical Sampling and Field Analytical Equipment
FT-13.01 Preparation, Approval, and Submittal of Periodic Field Reports
FT-13.02 Forms Used in RI Activities
FT-13.03 Site Logbook
HS-1.02 Decontamination
HS-1.06 Control of Contaminated Material
HS-1.12 Incident Investigation and Reporting

The above guidelines will be available for reference at the onsite office trailer. Sample documentation, packaging, and shipment of CLP samples will be performed in accordance with the

"User's Guide to the Contract Laboratory Program" dated December, 1986. A copy of this guideline will also be available in the office trailer.

These guidelines are not meant to be taken verbatim since field conditions often necessitate modifications or deviations from a particular procedure. For example: groundwater evacuation (purging) can be conducted in several ways, depending on the field conditions. If the water level is high (i.e., less than 15 feet from the top of casing), a suction pump would probably be used. However, if water levels in the wells are low (i.e., 50 feet below the top of the casing), then a bailer may be used. The sampling team leader should use his/her best judgment on how a particular sample shall be taken, or how a certain piece of equipment is decontaminated, using the FTGs as a reference/ guidance. For instance: one would not expect to perform a 7- or 8-step decontamination procedure on an M-scope during well construction. A simple cleaning with deionized water would suffice for this activity.

Specific procedures for drilling, aquifer testing, sampling, etc. that are outlined in Section 3.2 shall take preference over the FTGs. Additionally, the Site Geologist or FOL may use his/her technical experience and judgment on how a specific activity will be carried out. This is acceptable as long as the procedure used is documented in the field notebook and a Field Change Request (FCR) is approved by the Site Manager. Under no conditions will the FOL deviate from the scope of work without approval by the Site Manager, Regional Manager, and EPA.

A copy of the above FTGs will be made available and secured in the field office trailer, along with a copy of the Final FOP. A meeting will be held with the Field Sampling Team to review the above FTGs as part of the mobilization activities. Other guidelines (i.e., ASTM) are given in Appendix B.

3.1.3 Sample Identification and Chain-of-Custody

The site code for the Croydon TCE Site is CR. The sample types are

RW - Residential Well
MW - Monitoring Well
SO - Surface and Shallow Soils
SS - Subsurface Soils
SD - Sediment
SW - Surface Water
FB - Field Blank
TB - Trip Blank
BB - Bottle Blank

Each location will have the sampling station number (i.e., MW2(S), SW21, SO8, SD20, etc.) followed by the Series number (the series number would identify the number of samples obtained from a particular sampling station). For example, the first time monitoring well Number MW16(S) is sampled, the number for the sample shall be

CR-MW16(S)-1

If it is sampled again at another period in time, the sample number would become

CR-MW16(S)-2

For duplicates, a letter designation will be used for the duplicate sample. For example, the duplicate of CR-MW16(S)-1 will be

CR-MW16(S)-1A

If a duplicate is taken at that point again, the number would become

CR-MW16(S)-2A

It should be noted that well locations No. 1-15 and the Rohm & Haas Wells has been sampled previously, therefore, these sample locations should be designated with a "2" at the end of the sample code as noted above.

Field blanks will be designated by sample type followed by "FB." For example, the first field blank for each medium would be:

CR-MWFB-1

Bottle blanks will be designated by sample type followed by "BB." For example, the first bottle blank for groundwater would be:

CR-MWBB-1

Trip blanks shall be designated by sample type followed by "TB." For example, the first trip blank for each medium would be:

CR-MWTB-1

Monitoring wells that are owned by Rohm & Haas Company will also be sampled as part of this Phase II RI. Samples collected from Rohm & Haas wells shall be identified as follows:

Example

LF-13-18:
represents Rohm & Haas monitoring well No. LF-13-18.

CR-MW-(LF-13-18)-2:
substitute "well location number" with Rohm & Haas monitoring well number. Note that since this well was sampled previously, a "2" should be identified at the end of the sample code.

3.1.4 Sample Container Requirements and Holding Times

Sample container requirements and holding times are specified in Table 3-2.

3.1.5 Preservation Methods

Groundwater and surface water samples will be preserved with appropriate reagents as indicated in Table 3-2. Samples will be acidified by adding approximately 2 ml of the concentrated acid required. Water samples requiring sodium hydroxide will be preserved by adding 2 ml of concentrated sodium hydroxide or, an appropriate amount of sodium hydroxide pellets to bring the pH to >12. The sample bottle will be capped then inverted to distribute the preservative until homogenous. The cap will be removed and a portion of the sample will be poured into the cap. pH paper (narrow range) will be used to determine the required pH of the water as indicated in Table 3-2. The water in the cap will be discarded and the cap will be tightened on the bottle. If the desired pH is not obtained, the above method will be repeated until the desired pH is reached. The above method will be used for all water samples requiring pH adjustment. FT-7.06 provides additional details on preserving samples. The filtering apparatus will be field decontaminated by the procedure stated in Section 3.4.

3.1.6 Sample Packaging and Shipping

Samples will be packaged and shipped in accordance with FT-7.07. The Sampling Team Leader will be responsible for contacting the EPA Sample Management Office (SMO) for each shipment of samples and will report the following:

- Dates the samples were shipped
- Types of samples
- SMO case number
- Number of samples
- Airbill number
- Laboratory that the samples were shipped to

SMO and the Regional Laboratory Sample Coordinator (RLSC) should be contacted within the day the samples are shipped or the following morning. The SMO telephone number is 703-557-2490 and the RLSC telephone number is 215-752-0213.

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The RLSC will track sample shipment, receipt, analysis, and data validation and will be responsible for forwarding this information to the EPA CRL. A weekly sampling summary sheet (see Appendix C) shall be completed and forwarded to the RLSC at the end of the working week. The summary sheet will then be forwarded to the EPA CRL.

Note: This reporting procedure only applies to samples which are being sent to a CLP laboratory. Samples being analyzed by a REM III Team laboratory should only be logged in the appropriate documents (i.e., site logbook, field notebook). Daily communication with the RLSC is required in order to plan daily laboratory activities. REM III laboratories will only be used if CLP cannot accommodate the samples. This investigation assumes that all of the samples will be analyzed by CLP laboratories.

3.1.7 Documentation

A bound, weatherproof field notebook shall be maintained by the individual field teams. The FOL or designees, shall record all information related to sampling or field activities. This information may include sampling time, weather conditions, unusual events (well tampering), field measurements, etc.

In addition to the field notebooks, one site logbook shall be maintained. The requirements of the site logbook are outlined in FT-13.03 which will be found in the onsite office trailer. Essentially, this book will contain a summary of the day's activities and will reference the field notebooks when applicable.

3.1.8 Field Audits

Two Quality Assurance (QA) performance audits will be performed by a designated QA Specialist during the Phase II remedial investigation. The first audit will be performed during the first or second week of the field investigation. A follow-up audit will be conducted to verify that nonconformances, which may be identified during the initial audit, have been addressed and resolved. The audit will include checks on adherence to all sampling protocols. Audit findings will be documented and distributed to project team members. Pre-mobilization meetings will be conducted to review applicable FTGs and familiarize the Field Sampling Teams with the scope of work and quality of work that is expected to be implemented in the field.

3.1.9 Procedures for Field Change and Corrective Action

Corrective action may be initiated as a result of audits, field observations, or complaints. Under the REM III Program, all changes or deviations from this FSAP must be documented in the field notebook and a Field Change Request Form must be initiated. (An example of this form can be found in

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Appendix C.) The Field Operations Leader shall contact the Site Manager, or designee, and explain the reason for the deviation or change. After discussing the situation with the Site Manager, corrective action will be determined and initiated. The Ebasco RPM will be notified of any significant change. The FOL is required to document all field changes on the Field Change Request Form and return it to the Site Manager (at the most convenient time, i.e., end of work week), who will sign it and distribute it to the Regional Manager, Quality Assurance Manager, Sampling Team Leader, and project file. A copy shall be kept at the onsite office trailer with the FSAP.

3.1.10 Field Instrumentation

Numerous monitoring instruments will be used during activities and may include the following:

- Temperature probe
- Specific conductance meter
- pH meter
- Photoionization meter
- Eh meter
- Organic vapor analyzer or HNU
- Electronic water level meter

The temperature probe, conductivity meter, HNU and pH meter will be calibrated according to the manufacturer's operating manual prior to each day's use. The other above-mentioned instruments shall be calibrated prior to mobilization and periodically at the discretion of the FOL. Calibration will be documented on an Equipment Calibration Log (FT-13.02). During calibration, an appropriate maintenance check will be performed on each piece of equipment. If damaged or failed parts are identified during the daily maintenance check and it is determined that the damage could have an impact on the instrument's performance, the instrument will be removed from service until the identified parts are repaired or replaced.

3.1.11 Material Handling

During the course of the remedial investigation, potential hazardous waste materials may be generated during various sampling activities including: drilling, well development and evacuation, and decontamination of equipment and personnel. These potential waste materials may include drill cuttings, decontamination fluids, evacuated groundwater, and personal protective clothing. The following procedures will be employed during the generation, handling, and storage of these materials.

3.1.11.1 Drill Cuttings

All drill cuttings will be monitored with an HNU for the presence of organic vapors. Drill cuttings that exhibit elevated readings above background shall be containerized in 55-gallon drums (DOT approved) supplied by the drilling

subcontractor. The drums shall be identified as "drill cuttings" with white enamel spray paint. A sample of the drill cuttings shall be collected at a convenient time and forwarded to a fixed laboratory for TCL organics analysis. Drums shall be placed at the Bristol Township Sewage Plant property along River Road in Croydon. Following the RI field activities, the drums will be removed by a qualified, licensed, hazardous waste haulers.

3.1.11.2 Evacuated Well Water

Upon the initial development or purging of monitoring wells, a sample shall be collected for headspace analysis. If no elevated readings above background are detected, then evacuated well water will not have to be contained. However, if elevated readings are observed, the evacuated well water shall be contained in a large holding tank. A sample shall also be collected for analysis of TCL organics. A large tanker or holding tank shall be obtained by the driller.

3.1.11.3 Test Borings

Drill cuttings shall be placed back into the test borings.

3.1.11.4 Decontamination Fluids

Fluids generated during the decontamination of equipment and personnel shall be analyzed via headspace analysis prior to discharging onsite. However, if elevated readings are observed, the decon fluids shall be contained in 55-gallon drums. The drums shall be staged onsite at the previously-mentioned designated area. The contents of each drum shall be clearly identified with white enamel spray paint as "decon fluids." A sample shall be taken for TCL organics analysis.

3.1.11.5 Disposables

Personal protective clothing (i.e., latex gloves, tyvex, etc.) and sampling equipment (i.e., wooden scoops, etc.) shall be double-bagged and secured in a 55-gallon drum at the end of each work day, or on an as needed basis. The drums shall be identified with white enamel spray paint as "disposables" and placed at the previously-mentioned drum staging area.

3.2 FIELD INVESTIGATION ACTIVITIES

3.2.1 Phase II Hydrogeologic Investigation

3.2.1.1 Number of Wells and Locations

Five well locations, consisting of nine monitoring wells, will comprise the Phase II drilling program. A shallow and deep well will be installed at four locations and the fifth location will only consist of a shallow well. The well clusters will provide data to determine lateral and vertical variations in contaminant

concentrations, determine vertical flow components within the aquifer, and provide data for determining groundwater flow patterns.

The proposed monitoring well locations (CR-MW16 through CR-MW20) are shown in Figure 3-1. The rationale for each well location and the primary functions for each well cluster are discussed in Section A.4.3.2 of the Phase II RI/FS Work Plan. The proposed well locations were selected by the REM III Team with input from EPA based on the locations of suspected source areas, the observed locations of TCE contaminated wells, the locations of existing groundwater monitoring points presently available for sampling, the overall expected groundwater flow pattern for the area, and the data requirements of the Phase II RI/FS.

3.2.1.2 Drilling Operations

The preferred method for drilling monitoring well borings is by hollow stem auger. The only drilling fluids approved for use if needed are potable water or a drilling mud mixed from potable water and pure bentonite. No organic based additive may be added to drilling fluids. Previous drilling activities in the site area utilized hollow stem auger.

Monitoring well borings or auger casings must be of an adequate diameter (nominal 6 inches or more) so that 2-inch diameter PVC wells can be properly installed. The general Ebasco preference for drilling methods at hazardous waste sites is hollow stem auger, air rotary, cable tool, mud rotary, and drive and wash/spinning casing, in that order of preference. Drillers are not bound to select the most preferred option; however, mud rotary has not been approved by EPA Region III.

During drilling operations of monitoring well borings, Standard Penetration Tests will be performed and split-barrel soil samples taken at 5-foot intervals or as requested by the site geologist in the deepest well at each cluster location or at each well at a single well location, in accordance with ASTM D-1586-84, starting at 0.0 to 1.5 feet. Each soil sample will be placed in a 8-ounce jar, labeled, pertinent data recorded (project, boring, and sample numbers, depth, blow counts, and date), and submitted to the Site Geologist. The remaining boring at each cluster location need not be sampled. The boring log for each boring will be maintained by NUS. Lithologic samples will be described using the Unified Soil Classification System (USCS). The following information, when applicable, will be included in the boring log prepared for each boring that is sampled:

- Sample numbers and types
- Sample depths
- Standard Penetration Test data
- Sample recovery/sample interval
- Soil density or cohesiveness

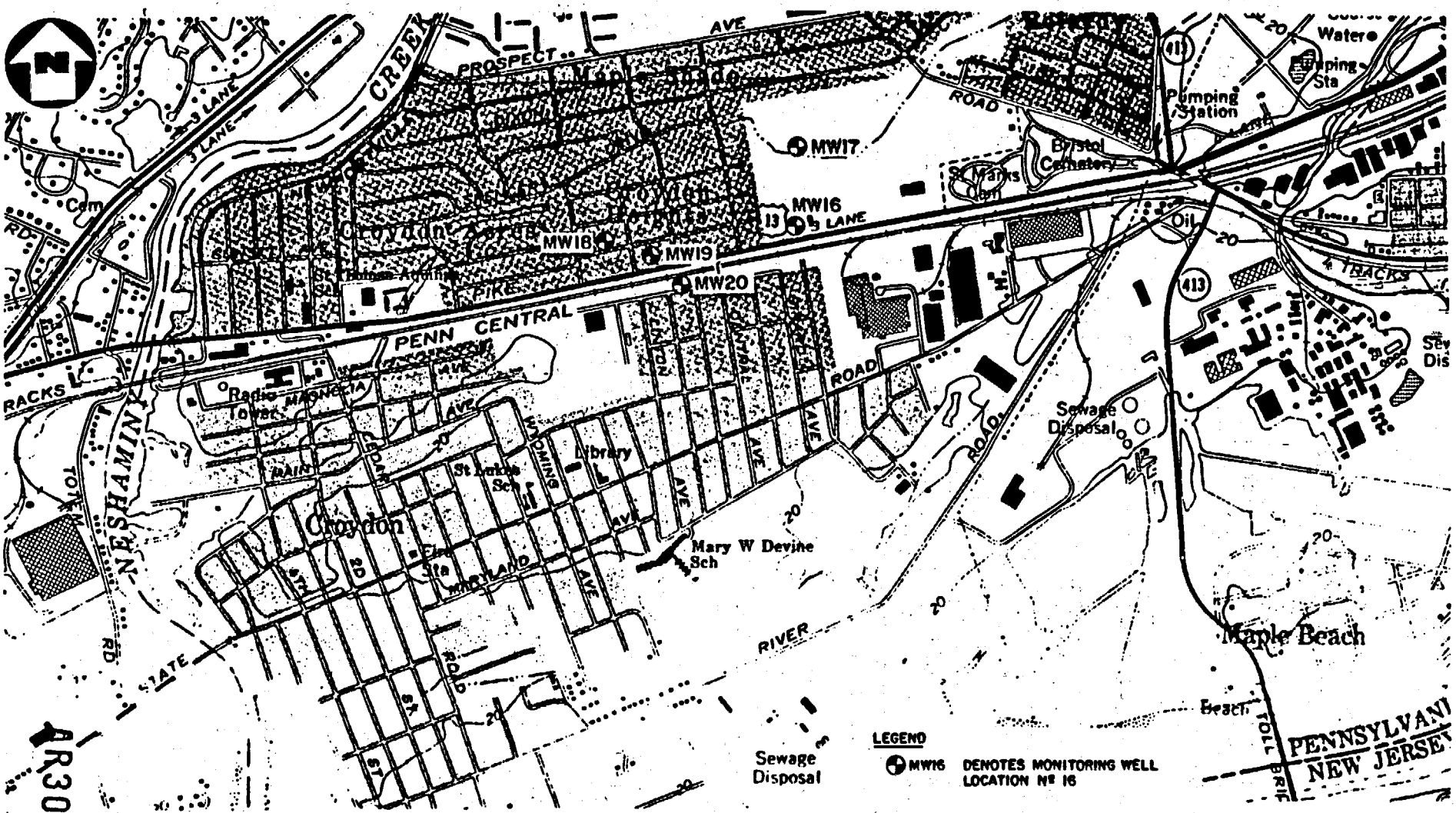

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FIGURE 3-1

PROPOSED PHASE II MONITORING WELL LOCATIONS
CROYDON TCE SITE, BUCKS COUNTY, PA

SCALE IN FEET

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- Soil color
- USCS material description and symbol

In addition, depths of changes in lithology, sample moisture observations, depth to water, OVA or HNU readings, drilling methods, and total depth of each borehole should be included on each log, as well as any other pertinent observations that may be made.

3.2.1.3 Monitoring Well Construction

Monitoring wells shall be constructed of 2-inch diameter, nonglued-flush-joint, threaded, Schedule 40 PVC casing and well screens equipped with a 2-foot trap below the screen and a PVC end plug and vented cap. The trap will be used to collect the DNAPL, if present. Figure 3-2 illustrates typical well construction details for a monitoring well. Table 3-3 provides a summary of monitoring well construction details. Monitoring well construction and installation activities must be performed to the satisfaction of the Site Geologist and in accordance with the methodology described in this section.

Well screens will be 10 feet in length and slot size will be 0.02 inches. The PVC well installation procedure will consist of placing the PVC pipe and screen into the completed boring and backfilling the annulus of the boring, around the well screen and approximately 1-3 feet above the well screen, with clean quartz sand (#20-#30 U.S. Standard Sieve Size). A bentonite pellet seal (minimum 2-foot thickness) will then be installed; the remainder of the annulus of the boring will be backfilled with a cement-bentonite grout to ground surface. The exact depths of all backfill materials will be determined in the field by the Site Geologist, based on the observed subsurface conditions at each boring location. Backfill depths should be constantly monitored by the driller during the well installation process by means of a weighted steel, plastic, or fiberglass tape to the satisfaction of the Site Geologist. Casing centralizers will be used for wells greater than 35 feet, if deemed necessary by the Site Geologist.

Protective steel casings (minimum 6 inch diameter, 5 feet in length) equipped with locking caps shall be installed around all wells. Locks are to be supplied by the driller and must be keyed alike. The locking caps must be adequate to prevent unauthorized access to the monitoring wells, and are subject to approval by the Site Geologist. Two, small, 1/4-inch holes should be drilled at the base of the stickup of the protective casing, to allow water drainage from inside the protective casing. In some cases, flush mounted protective casings may be required at locations where a protruding casing would be undesirable (near roadways). Typical design details for these casings are shown in Figure 3-3.

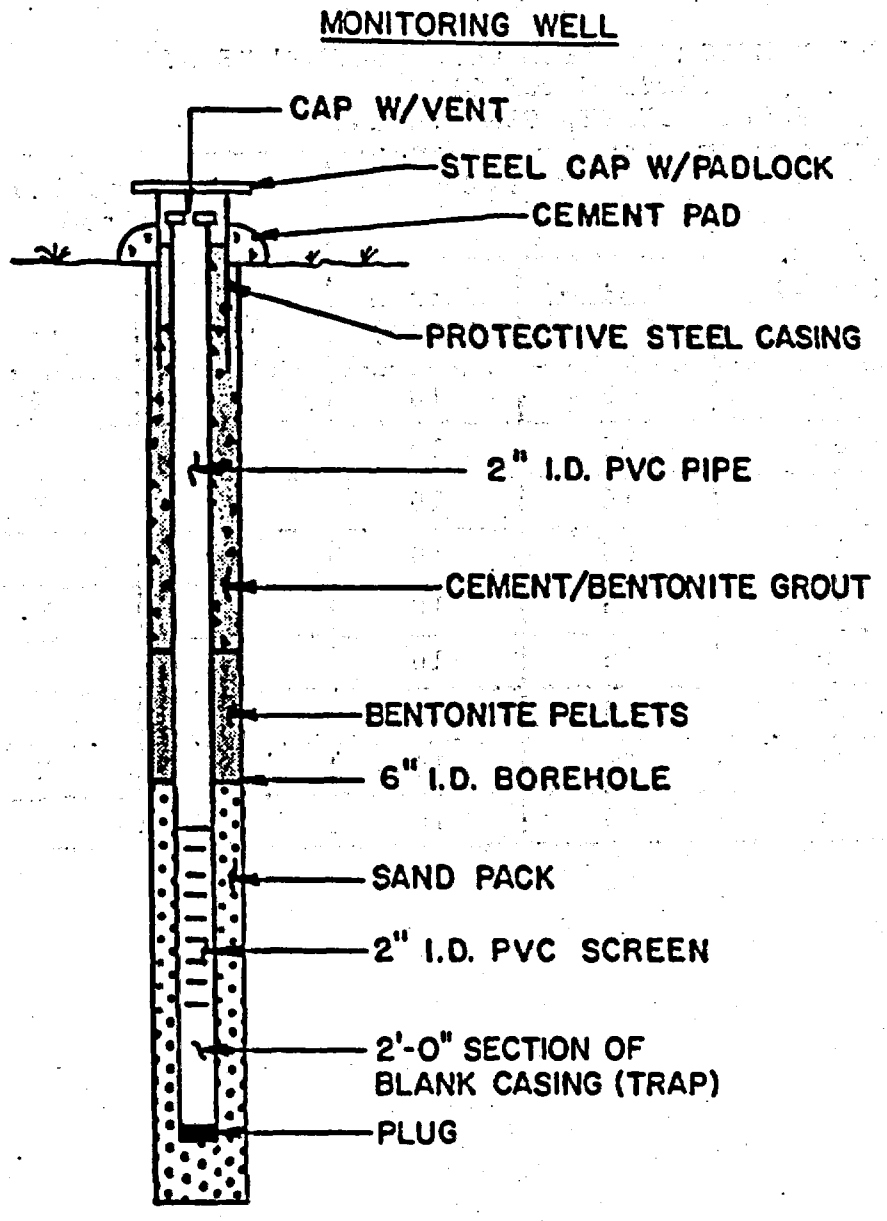

FIGURE 3-2

MONITORING WELL CONSTRUCTION DETAILS
CROYDON TCE SITE, BUCKS COUNTY, PA

NOT TO SCALE

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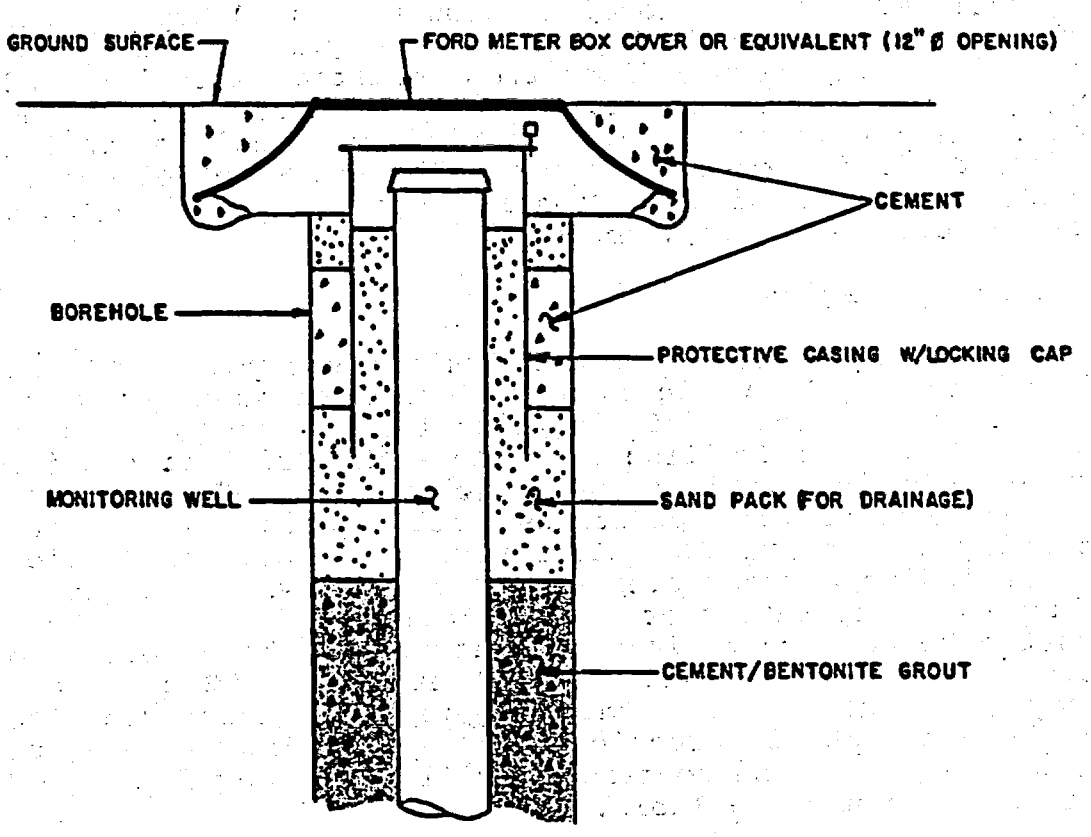
TABLE 3-3

ESTIMATED MONITORING WELL CONSTRUCTION DETAILS
CROYDON TCE SITE
BUCKS COUNTY, PENNSYLVANIA

Well Number	Estimated Depth (Feet)	2" PVC		Soil Sampling Required	
		Casing (Feet)	Screen (Feet)	Yes	No
MW16-S	25	15	10		X
MW16-D	65	55	10	X	
MW17-S	25	15	10		X
MW17-D	65	55	10	X	
MW18-S	25	15	10		X
MW18-D	65	55	10	X	
MW19-S	25	15	10	X	
MW20-S	25	15	10		X
MW20-D	65	55	10	X	



FLUSH MOUNTED
PROTECTIVE CASING INSTALLATION
CROYDON TCE SITE, BUCKS COUNTY, PA

NOT TO SCALE

FIGURE 3-3

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3.2.1.4 Well Development

Monitoring wells will be developed no sooner than 24 hours after installation. Wells may be developed by pumping, surging, and/or air lifting, to remove fines from formation materials and remove any residual drilling fluids from the area around the well screen. Well development will be performed until formation water is free of fines, or until approved by the Site Geologist. Well development water will be contained if elevated organic vapors are detected above background.

3.2.1.5 Decontamination

All downhole drilling, sampling, and testing equipment and the back end of the drilling rig must be steam cleaned prior to beginning monitoring well drilling/installation work, between boreholes, any time the drilling rig leaves the drill site prior to finishing a boring, and at the conclusion of the drilling program. Decontamination operations will consist of washing equipment using a high-pressure steam wash. All decontamination equipment, including a steam cleaner and potable water, is to be provided by the subcontractor. Monitoring well casing and screens must also be decontaminated as described above, prior to installation. As an alternative, NSF approved PVC pipe and screens may be used without steam cleaning. Decontamination water will be contained if organic vapor monitoring levels are above background. The subcontractor will have 55-gallon (DOT Specification 17) drums available.

NUS will provide a centralized location for decontamination operations. This location will be determined during the mobilization activities. The driller shall have plastic sheeting available for setting up a temporary decontamination pad. The decontamination pad shall be constructed to slope in one direction, with a collection sump installed at the lower end of the pad.

3.2.1.6 Aquifer Testing

Monitoring wells will be used for aquifer testing to determine the groundwater flow conditions in the alluvial aquifer investigated at the site. The data generated from these tests will be used to define the water-yielding characteristics of the formation, develop groundwater velocity values for the alluvial aquifer, and estimate the rate of groundwater movement across and away from the site. Slug tests or short-term pumping tests will be performed in the monitoring wells and evaluated using the most appropriate evaluation technique for each type of test and for each individual set of hydrogeologic conditions. Pressure transducers and data loggers will be used for data collection, where appropriate, to obtain the most accurate field data possible. M-scope or popper water level measuring devices may also be used where appropriate. It is anticipated that each new monitoring well will be tested.

3.2.1.7 Water Level Monitoring

At least two comprehensive rounds of water levels will be taken from 9 Phase II monitoring wells, 29 Phase I monitoring wells and 62 Rohm & Haas monitoring wells. Table 3-4 lists the monitoring wells which shall be used for static water level measurement. Staff gauge readings along Hog Run Creek and the small intermittent stream north of Potential Source Area No. 1 will be recorded during each round of water level measurements. All measurements for each collection round shall be collected within a 24-hour period of consistent weather conditions to minimize atmospheric effects on groundwater conditions.

Measurements will be taken with an M-scope (electrical water-level indicator) or popper, using the top of the well casing as the reference point for determining depths of water. These water levels will be used to determine groundwater flow directions and to identify any variations which may occur in flow directions throughout the study area over time.

3.2.1.8 Reporting

The following reports and documentation will be the responsibility of the Site Geologist during the drilling activities. A copy of applicable forms that will be used by the Site Geologist are located in Appendix C.

Site Logbook - See REM III Program Guidelines FT-13.03.

Daily Record Surface Investigation Report - See Appendix C.

Boring Log - See Appendix C.

Overburden Monitoring Well Sheet - See Appendix C.

Data Sheet for Pumping Tests - See Appendix C.

Groundwater Level Measurement Sheet - See Appendix C.

Weekly Field Summary Report - See Appendix C.

The Site Geologist's logbook shall contain information about the drilling activities such as start/finish times, standby times and problems or changes encountered during drilling. Drilling/monitoring well construction information (i.e., footage drilled, depth of casing, etc.) will be recorded daily on the boring log and the overburden monitoring well sheet. The boring log, along with the geologist's logbook, will be used to prepare the Daily Record-Subsurface Investigation Report. This report will identify drilling activity and quantities of material used on a daily basis, and shall be signed by the drill rig foreman (or equivalent) and the Site Geologist. The reports shall be submitted to the Site Manager at the end of each week. These reports are also used to fill out the Daily Logbook.

TABLE 3-4

PROPOSED MONITORING WELLS FOR STATIC WATER LEVEL MEASUREMENTS
CROYDON TCE SITE

Phase I REM III Wells	Phase II REM III Wells	Rohm & Haas Wells	
CR-MW01(S)	CR-MW16(S)	CR-18-55	CR-20-22*
CR-MW01(D)	CR-MW16(D)	CR-18-30	CR-20-38*
CR-MW02(S)	CR-MW17(S)	CR-19-15	CR-6-20*
CR-MW02(D)	CR-MW17(D)	CR-19-37	CR-102-22*
CR-MW03(S)	CR-MW18(S)	CR-23-32	CR-103-36*
CR-MW03(D)	CR-MW18(D)	CR-23-53	CR-104-27*
CR-MW04(S)	CR-MW19(S)	CR-24-7	CR-106-28*
CR-MW04(D)	CR-MW20(S)	CR-24-16	CR-101-26*
CR-MW05(S)	CR-MW20(D)	CR-25-13	CR-8-17*
CR-MW05(D)		CR-25-34	P-1-25*
CR-MW06(S)		CR-26-19	CR-2-58*
CR-MW06(D)		CR-26-38	CR-17-29*
CR-MW07(S)		CR-27-18	CR-17-52*
CR-MW07(D)		CR-27-38	CR-16-28*
CR-MW08(S)		LF-13-18	CR-16-40*
CR-MW08(D)		LF-13-43	CR-13-18*
CR-MW09(S)		LF-14-20	CR-13-22*
CR-MW09(D)		LF-15-26	CR-14-23*
CR-MW10(S)		LF-15-37	CR-15-13*
CR-MW11(S)		CR-21-17*	CR-29-59*
CR-MW11(D)		CR-21-27*	CR-28-53*
CR-MW12(S)		CR-21-38*	CR-3-22*
CR-MW12(D)		CR-22-18*	CR-3-45*
CR-MW13(S)		CR-4-20*	CR-5-27*
CR-MW13(D)		CR-4-50*	CR-7-20*
CR-MW14(S)		P-2-10*	CR-107-25*
CR-MW14(D)		CR-1-22*	CR-105-19*
CR-MW15(S)		CR-1-50*	CR-108-16*
CR-MW15(D)		CR-2-27*	CR-109-18*
		P-6-20*	W-18-32**
		P-7-21*	W-17-30**

* Wells are located south of River Road
** Wells are located east of Route 413

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3.2.2 Groundwater Sampling

Sampling and analysis of groundwater will be performed to define the horizontal and vertical extent of contamination, to delineate the contaminant plume(s), to provide sufficient data for the assessment of public health and environmental effects, and to evaluate remedial action alternatives. Sixty-nine monitoring wells will be sampled during the Phase II RI. The groundwater sampling program will consist of sampling 9 newly installed monitoring wells, 29 existing REM III (Phase I) monitoring wells, 22 Rohm & Haas monitoring wells, and 9 residential wells.

3.2.2.1 Monitoring Wells

One round of groundwater samples will be collected from 38 REM III monitoring wells and 22 Rohm & Haas monitoring wells. The location of these wells is shown in Figure 3-4. Based on the Phase I RI analytical data, volatile organic compounds are considered the principle groundwater contaminants of concern. Consequently, all groundwater samples will be analyzed for Target Compound List (TCL) volatile organic compounds using EPA Method 601/602.

Field measurements to be taken on all monitoring wells include:

- pH
- Specific conductance
- Temperature
- Dissolved Oxygen

These parameters will be measured by onsite calibrated field instrumentation (analytical option Level 1).

Sampling and analysis protocols and QA/QC sample requirements are outlined in Table 3-2. Duplicate samples (a total of three) shall be taken from well location CR-21 (this location consists of a shallow and intermediate, and a deep well).

Field blanks (a.k.a. Equipment Rinsate Blank) will be obtained under representative field conditions by running analyte-free deionized water through sample collection equipment (bailer) after decontamination and placing it in the appropriate sample containers for analysis. These samples are used to determine if decontamination procedures are sufficient. One field blank should be taken for every 20 monitoring wells samples (see Table 3-2).

Bottle blanks are obtained by pouring analyte-free deionized water into a set of sample collection bottles. They serve as an oversight function in assessing the effect of residual contamination in the sample collection bottle. One bottle blank should be taken for every 20 monitoring wells sampled (see Table 3-2).

Figure 3-4 - See Back Pocket

Trip blanks (volatiles only) will be prepared in the field prior to the sampling event. Analyte-free deionized water is poured directly into the sample jar and then packaged for shipment with other samples. At no time after their preparation are trip blanks opened before they reach the laboratory. A trip blank should be prepared for every shipment (one per cooler) of volatile organic samples.

Groundwater samples will be collected in accordance with FT-7.0.2. Prior to obtaining the groundwater sample, the wells shall be purged using stainless steel bailers or with a teal pump. Three to five well volumes will be purged. If the wells are purged dry with less than three well volumes removed, then the water level should be allowed to completely recover prior to taking a sample. (Water level measurements shall be taken prior to purging.) Field measurements including pH, temperature, and specific conductance shall be taken before purging commences, at each well volume interval, and at the end of purging. Less than five volumes may be purged if the above field measurements stabilize.

3.2.2.2 Residential Wells

The residential well sampling and analysis program is summarized in Table 3-2. A total of 9 residential wells will be sampled and analyzed for TCL volatile organics using EPA Method 601/602. Wells to be sampled for TCL volatile organics include residential wells located in the vicinity of the plume and one residential well located near Neshaminy Creek that exhibited trichloroethene at the MCL of 5 µg/l (RW32). Figure 3-5 depicts the location of these wells.

Analytical options were selected to ensure the data collected are of sufficient quality for the intended data use. To support the Phase II public health assessment, Level IV analytical option was selected.

Residential well samples shall be collected using the following procedures:

1. Obtain the well depth, casing size, and holding tank volume. Calculate the volume of water in the system as follows:

   Well volume (gallons) = π (radius of well casing in ft)^2 (feet of water standing in the well) (7.48 gallons/ft^3).

   Total water volume (gallons) = well volume + holding tank volume.

Note: Well depth, casing size, and holding tank volume may be available from the Site Manager following the acquisition of questionnaires that were issued to the well owners.

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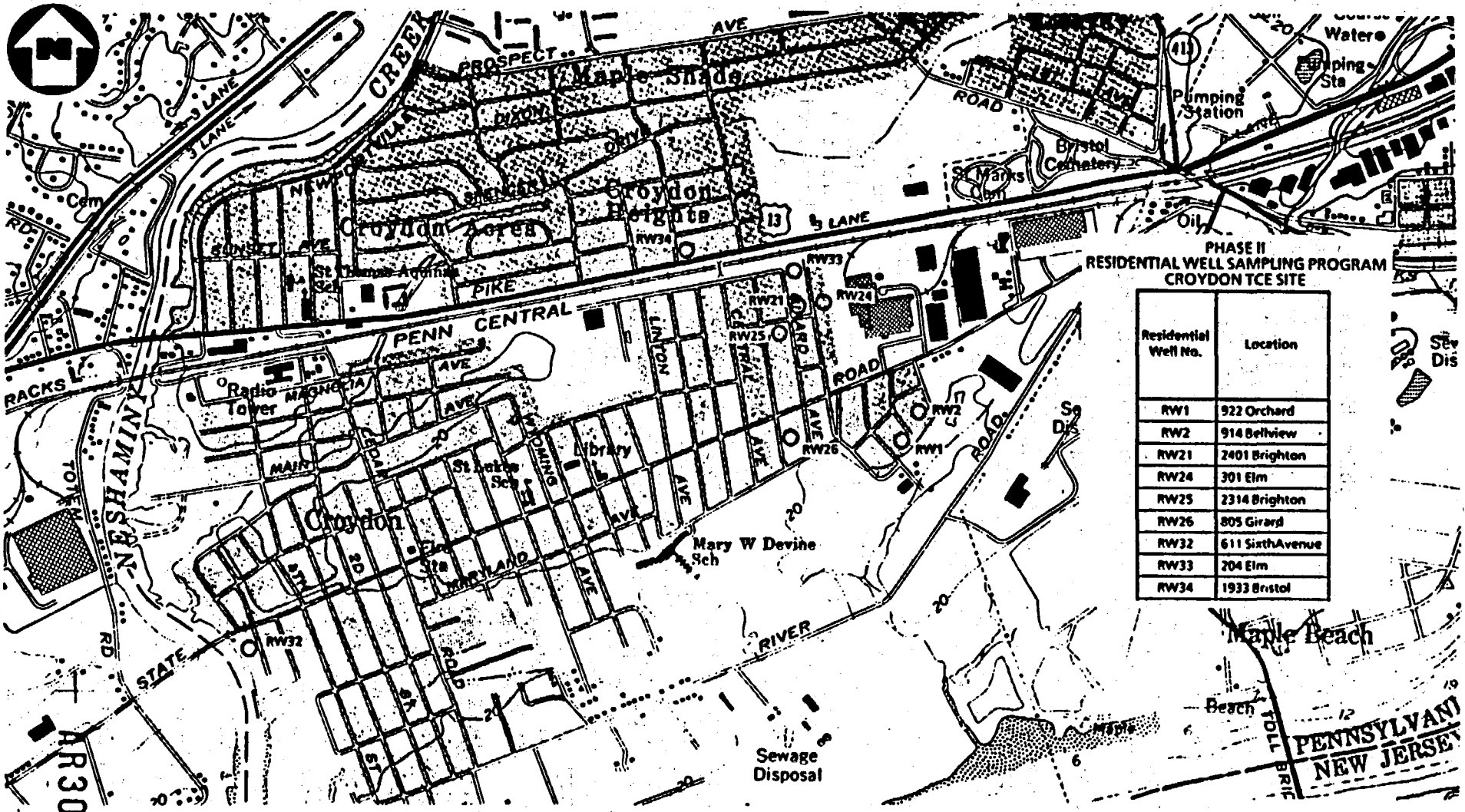

FIGURE 3-5

PHASE II RESIDENTIAL WELL SAMPLING PROGRAM
CROYDON TCE SITE, BUCKS COUNTY, PA

0 1000 2000
SCALE IN FEET

NUS CORPORATION

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2. If a tap is available between the well head and the holding tank, purge three to five well volumes from the system. If no tap is available, purge the total water volume calculated above from the system plus two additional well volumes. If information concerning well depth or holding tank volume is not available, purge the well for 15 minutes.

Note: When purging from an outside tap, route the water away from the house or to a drain using a garden hose.

3. Collect the sample from the tap closest to the well head, before the water is processed through any water-treatment devices. If it is not possible to sample before a treatment device, note this in the sample notebook. Do not take the sample from the garden hose used to route the water away from the house.

Note: Some well owners may be reluctant to allow their water to run for the period of time involved in purging three well volumes. Community relations considerations must be weighted against the need to obtain a representative sample, with the sampler having to make a judgment as to what actions should be taken. Exact times of purging must be recorded.

Duplicate samples shall be taken from the Johnson residence (922 Orchard Avenue) and the Hayden residence (1188 Bristol Pike). Field blanks will not be required for residential well sampling since the sample is not collected via a sampling device (the sample is obtained directly from the tap). One bottle blank is required. Trip blanks (volatiles only) are required for every shipment (one per cooler).

3.2.2.3 Suspected DNAPL Samples

A white immiscible liquid was observed in groundwater during the development and purging of some of the Phase I monitoring wells. This liquid was usually observed after several minutes of pumping. Therefore, the DNAPL sample can only be obtained during purging. The liquid may be a Dense Nonaqueous Phase Liquid (DNAPL) since it sank to the bottom of the holding container during Phase I sampling activities. Since the presence/absence of contaminants associated with this liquid is unknown, it will be sampled during the Phase II RI if observed. A maximum of three samples will be collected and analyzed for the following parameters:

- TCL volatile organics (with expanded list of TICs)
- TCL base-neutral/acid extractable organics (with expanded list of TICs)
- TCL pesticides/PCBs
- Target Analyte List (TAL) inorganics
- Cyanide

- Total Organic Carbon
- pH, Eh, temperature, dissolved oxygen and specific conductance

These data are required to support site characterization, the public health and environment assessment, and the feasibility study. Level IV analyses was selected to meet the project objectives.

Table 3-2 outlines the bottle requirements, preservation requirements, and holding times, for the various analyses. Samples shall be taken from any (only three samples total are required) of the following monitoring wells, which were observed to contain this white liquid during the Phase I RI:

- MW1(S)
- MW1(D)
- MW2(D)
- MW3(D)
- MW4(D)
- MW7(S)
- MW8(S)
- MW10(D)
- MW11(D)
- MW12(D)
- MW14(S)

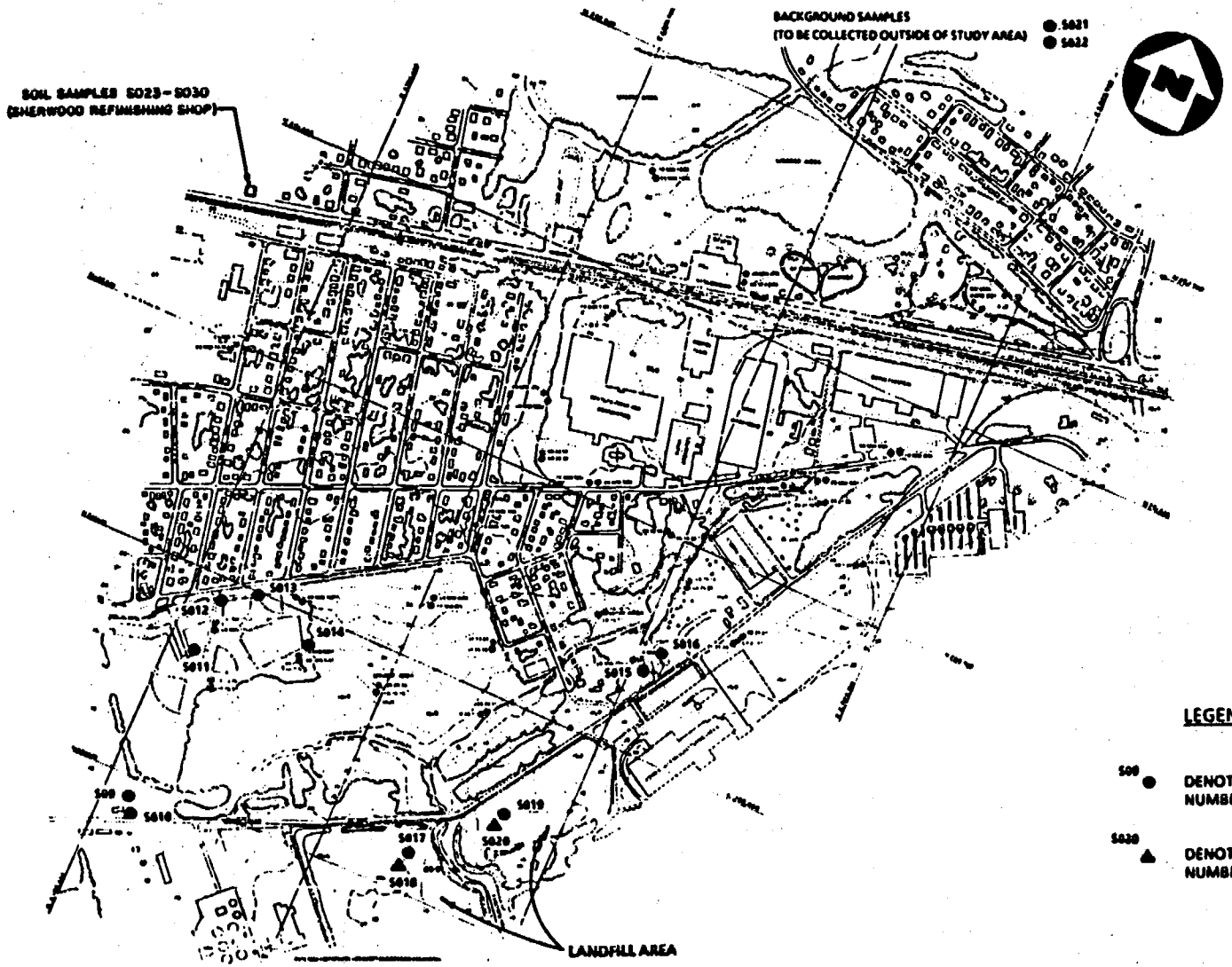
One duplicate sample will be required. The FOL will determine which monitoring well the duplicate sample shall be taken from. Field blanks or bottle blanks are not required; however, a trip blank shall be included (one per cooler).

3.2.3 Surface and Shallow Soil Investigation

3.2.3.1 Alleged Landfill Dumping Areas

A soil sampling and analysis program will be conducted during the Phase II RI to confirm the presence/or absence of contaminants, to establish background concentrations, and to evaluate the Rohm & Haas landfill as a potential contaminant source. Figure 3-6 illustrates the Phase II RI soil sampling locations.

Surface soil samples (0-6 inches) will be collected from each of the previously sampled locations (i.e., athletic fields, area in the vicinity of MW15, and in the yard of the private residence) to confirm the presence/absence of contamination. A total of eight samples will be taken as shown on Figure 3-6. (These eight samples are depicted as SO9 through SO16 on Figure 3-6.)



PHASE II SURFACE AND SHALLOW SOIL SAMPLING LOCATIONS
CROYDON TCE SITE, BUCKS COUNTY, PA

FIGURE 3-6

NUS CORPORATION

To establish background concentrations, two background samples will be collected. Exact sample locations will be determined in the field to ensure that the samples are obtained outside of the study area. (These samples are depicted as SO21 and SO22 on Figure 3-6.)

To determine whether the landfill is a potential contaminant source, two surface (top 6 inches) and two shallow (36 inches-48 inches) soil samples will be collected from the Rohm & Haas landfill area (see Figure 3-6). The shallow soil samples will be collected at a depth of 4 feet using a hand auger. (These samples are depicted as SO17 through SO20 on Figure 3-6.)

All samples collected will be submitted for analysis for the following parameters:

- TCL Base/Neutral/Acid extractable organics.
- TCL Pesticides/PCBs.

Table 3-2 outlines the sampling and analytical requirements. These data are required to support the public health and environmental assessment. To support the DQOs, Level IV analytical option was selected.

Surface soil samples will be collected in accordance with REM III Guideline FT-7.03. A stainless steel trowel or hand auger will be used to collect the soil samples. The samples shall be collected from depths of approximately 0 to 6 inches (surface soils), and 36 to 48 inches (shallow), placed in appropriate sample containers, and submitted for analysis as described in Table 3-2. Note that shallow soil samples are only to be collected in the Rohm & Haas landfill, as shown on Figure 3-6.

One duplicate sample shall be taken from the landfill area. Additionally, a trip, field, and bottle blank is also required.

3.2.3.2 Sherwood Refinishing Shop

In order to investigate Potential Source Area No. 3b (Sherwood Refinishing Shop), four surface (top 6 inches) and four shallow (36 inches-48 inches) soil samples will be collected from the back yard area of the refinishing shop. Exact locations for collecting these samples will be determined in the field by the FOL, after consulting with the Site Manager. The samples will be collected where stressed vegetation is noted or where dumping of solvents is suspected. (The surface and shallow soil samples are depicted as SO23 through SO30 on Figure 3-6.)

All eight samples shall be analyzed for TCL volatile organics. Additionally, two surface and two shallow soil samples shall be analyzed for BTU content, percent ash, and TOC.

One duplicate sample shall be taken from this area. Additionally, a trip, field, and bottle blank is required. See Section 3.2.3.1 for sampling methods.

3.2.4 Subsurface Soil Investigation

The general technical approach to the Subsurface Investigation includes a preliminary soil gas testing investigation to identify areas consequently warranting further study at Potential Source Area No. 1 and No. 3b, and a refined soil gas testing program to delineate the extent of the contamination. If contaminant "hot spots" are identified by the soil gas investigation, a confirmatory soil boring sampling and analysis program will be conducted.

3.2.4.1 Soil Gas Investigation

Soil gas testing is proposed for the entire Source Area No. 1. A preliminary soil gas survey will be conducted on an unbiased 200-foot grid (see Figure 3-7). A 200-foot grid was selected to provide adequate coverage of this suspected source area.

Soil gas testing will also be conducted at the Sherwood Refinishing Shop (within Potential Source Area No. 3b). Because this property is extremely small, a sampling grid of approximately 10 feet is proposed.

The data from the preliminary soil gas survey will be reviewed in the field with EPA and contaminated areas shall be identified, based on the soil gas results. A refined soil gas survey grid will then be generated and sampling will be conducted to further define the contaminated area(s). The number of grid points included in the refined survey cannot be determined at this time. Soil gas samples outside of Potential Source Area No. 1 and 3b will also be obtained to determine background levels.

The soil gas sampling equipment and procedures outlined below allow for the reproducible insertion of a specialized gas sampling probe into a soil matrix and permit the removal of representative vadose zone vapor samples for analysis.

Existing groundwater data indicate the presence of various organic compounds at elevated concentrations. Of the organics detected, the soil gas method will be most effective at detecting the following:

- Trichloroethene (TCE)
- Tetrachloroethene (PCE)
- Trichloroethane (TCA)

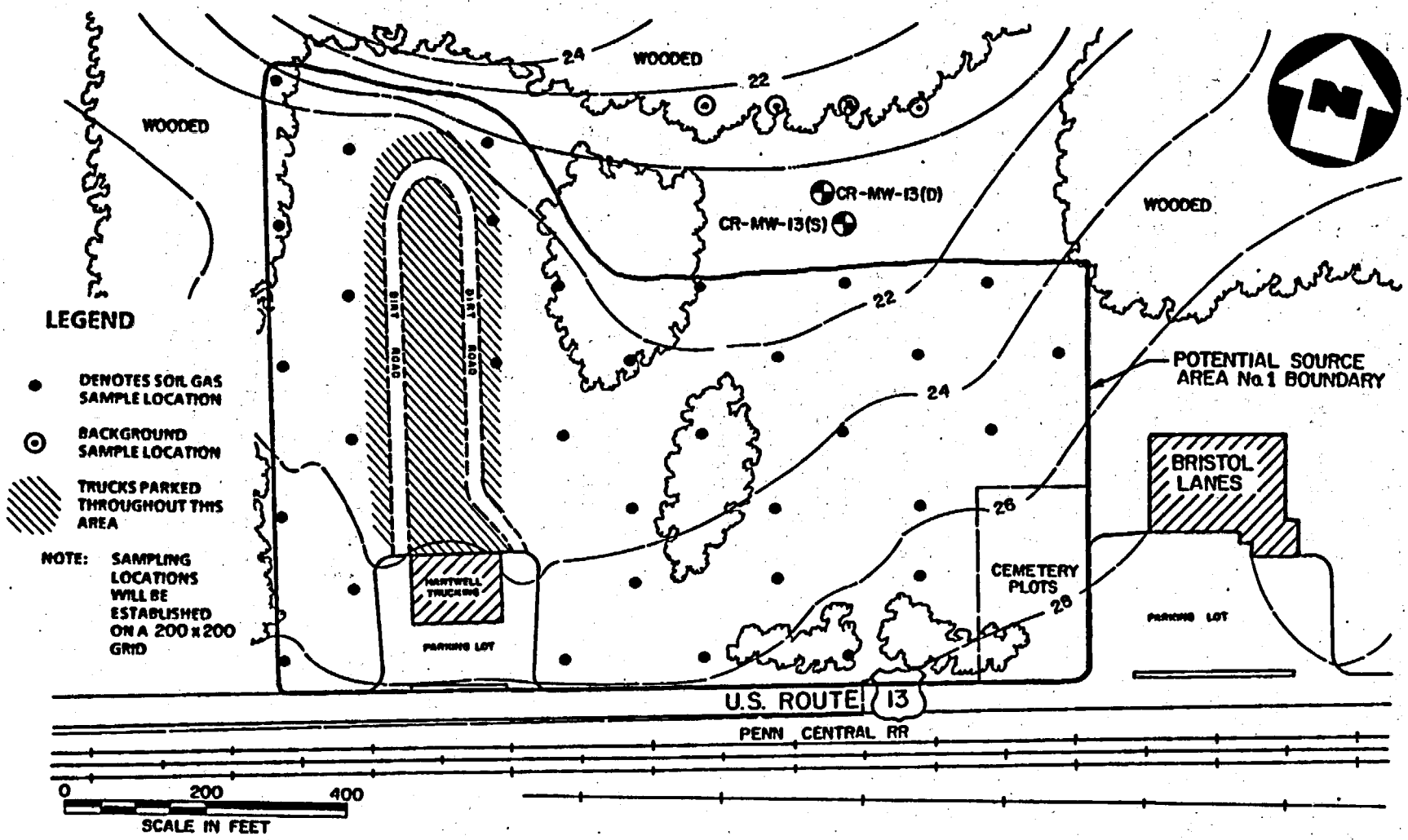


FIGURE 3-7

PROPOSED SOIL GAS SAMPLING LOCATIONS
CROYDON TCE SITE, BUCKS COUNTY, PA

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This soil gas investigation will accomplish the following goals:

- It will investigate sources of contamination at the site.
- It will preliminarily define the boundaries of any soil contamination detected.
- It will determine the placement of test borings.

Initially, soil gas samples will be collected at each grid point and immediately analyzed in the field. For Potential Source Area No. 1, the initial sampling will be performed on 200-foot spacing and will encompass the entire areal extent of this potential source area. This area is approximately 10 acres, so this entails approximately 32 samples (see Figure 3-7).

Based on the results of the above planned sampling, additional samples may be collected to better define the extent of contamination. These samples may be collected from areas of higher contamination to pinpoint potential source areas.

Soil gas sampling will be accomplished following the general soil gas procedure outlined in EPA-REM III Guideline FT-2.04. To collect each sample, a shallow borehole will be pounded or hand augered to the desired depth (2 to 4 feet) and the sampling probe will be placed in the hole (see Figure 4-6). The hole will then be sealed via a packer to exclude ambient air. Several volumes of soil gas will be extracted through the probe to decontaminate it from the previous sampling and an air sample will be collected with a gas-tight syringe. The probe will be removed, visible soil will be brushed off, and the probe will be positioned at the next sampling location. An attempt will be made to complete the borings to equal depths. This may be impossible where the water table is very shallow. In areas where the water table is 1.5 feet or less below the ground surface, water or saturated soil samples will be collected. These samples will be analyzed via the headspace technique (modified EPA Method 5020). The same compounds in the soil gas analysis will be included in the water or soil analysis.

Sample analysis will be accomplished using a Photovac Model 10S50 portable gas chromatograph with a photoionization detector. The Photovac will be calibrated to quantify TCE, TCA, and PCE which are indicative of the major organic contaminants that have been detected at the site. It will also be able to detect, but not quantify, fuel components.

After the Photovac has been set up at the site, gas standards will be prepared using the following procedure:

1. A VOA vial approximately half-full of the analyte in question will be equilibrated at a constant temperature (usually 25°C).

2. The vapor pressure of the analyte will be calculated at that temperature.

3. An appropriate aliquot of the vapor from the VOA vial will be injected into a Tedlar gas sampling bag containing ultra-pure, hydrocarbon-free air.

4. Using the same procedure, the other analyses will be injected into the Tedlar bag, creating a mixed standard for all the analyte being analyzed.

The Photovac will be calibrated at the beginning and end of each day using the standards prepared by the above procedure.

Standards will also be run at approximately 10 percent of the sample load. Additionally, QC will include blanks at 10 percent of the sample load and duplicates at 5 percent of the sample load. Any necessary additional QC will be performed if the situation warrants it.

Immediately following collection of a soil gas sample, the sample will be injected into the instrument. A chromatogram will be produced and the calibrated compounds will be quantified. Any compounds detected but not identified will be reported as unknowns. Sample chromatograms along with appropriate standards, QA/QC chromatograms, and data will be recorded in a log book. This log book will also contain all appropriate Photovac calibrations and set-up data. The detection limits are in the low- to mid-ppb range. Initially, standards will be prepared at approximately 50 ppb, but the working analytical range may be raised or lowered depending on sample concentrations detected.

The collected data will be tabulated showing the boring number, location, and associated contaminant concentrations. The boring locations will be assigned coordinates and the borings, along with their associated contaminant concentrations, will be plotted and isoconcentration figures will be produced. These figures will provide a strong indication as to where contamination is present. The soil gas results presented in these figures can then be used to help optimize the placement of the test pits.

3.2.4.2 Test Borings and Subsurface Soil Sampling

Areas within Potential Source Area No. 1 and No. 3b (Sherwood Refinishing Shop) exhibiting the highest degree of soil gas contamination will be evaluated further via a subsurface soil sampling and analysis program. Areas exhibiting the highest degree of contamination will be identifiable by evaluating isoconcentration plots of the soil gas data. A single soil boring will be installed at each "hot spot" identified on the isoconcentration map. Each soil boring will be drilled until the water table is reached, which may be as deep as 15 feet. Samples shall be collected continuously by split barrel or thin wall tube samplers (as determined by the field geologist), in accordance to ASTM D-1586-84 (Section 7) or ASTM D-1587-83.

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(Sections 6 and 7), which may be found in Appendix B. Sampling shall be discontinued upon reaching the water table.

In order to obtain enough soil necessary for soil sampling, a 3-inch split barrel sampler with a 300-pound hammer may be used. The lithology encountered in each soil boring shall be identified and logged during drilling operations in accordance with the procedures described in Section 3.2.1. An example of the soil boring description log can be found in Appendix C. Each boring shall be advanced using hollow stem augers in accordance with REM III Guideline FT-6.01 (Section 5.2.1). The estimated average boring depth is 15 feet. Guidance for obtaining the soil sample for subsequent chemical analysis is given in REM III Guideline FT-7.03.

During the drilling of the test boring, split-spoon samples will be pre-screened with an HNU and visual observations will be logged. Based on the levels of organic vapors detected by the HNU, or by visual observations, a decision to further delineate the "hot spot" will be made by the FOL following consultation with the Site Manager. This decision may be based on comparing organic levels and visual observations against those from other test borings. If a decision is made to further delineate a "hot spot", four test borings shall be drilled at each corner of the contaminated area. These four soil borings will assist in determining the horizontal and vertical extent of soil contamination. Split-spoon soil samples will be collected in each of the four borings as previously described. If no contamination is evident in the initial boring, then the additional four soil borings will not be required.

Table 3-2 outlines the analytical and sampling requirements. One duplicate sample, bottle blank, and field blank sample shall be taken for every 20 soil samples collected. Trip blanks (volatiles only) shall accompany each cooler.

For each area that is fully delineated (i.e., areas where the four additional borings are required), one soil sample shall be collected from each of the four borings and analyzed for the following parameters (see Table 3-2):

- pH
- BTU content
- Percent ash
- Grain size distribution
- Moisture content
- Nitrogen/Phosphorous
- CEC
- TOC
- COD
- BOD

The FOL will determine which sample shall be analyzed for the above parameters. This should be based on either visual

observation, or the split-spoon sample which exhibits the highest reading.

3.2.5 Surface Water and Sediment Sampling

Because of field constraints/limitations during the Phase I field investigation, surface water and sediment samples were not collected from the unnamed tributary located north of Potential Source Area No. 1, Hog Run Creek (adjacent to the Rohm & Haas landfill), and from the Delaware River. In order to fully characterize surface waters and sediments, samples from these surface water bodies will be obtained during the Phase II RI. The proposed Phase II surface water and sediment sampling locations are shown on Figure 3-8.

Surface water and sediment samples will be collected according to REM III Guideline FT-7.08. The samples will be collected from a relatively low-energy environment (quiet area of the stream) to provide a more representative sample. Samples will be placed in appropriate sample containers and submitted to the CLP for analysis as described in Table 3-2.

3.3 SAMPLE ANALYSIS

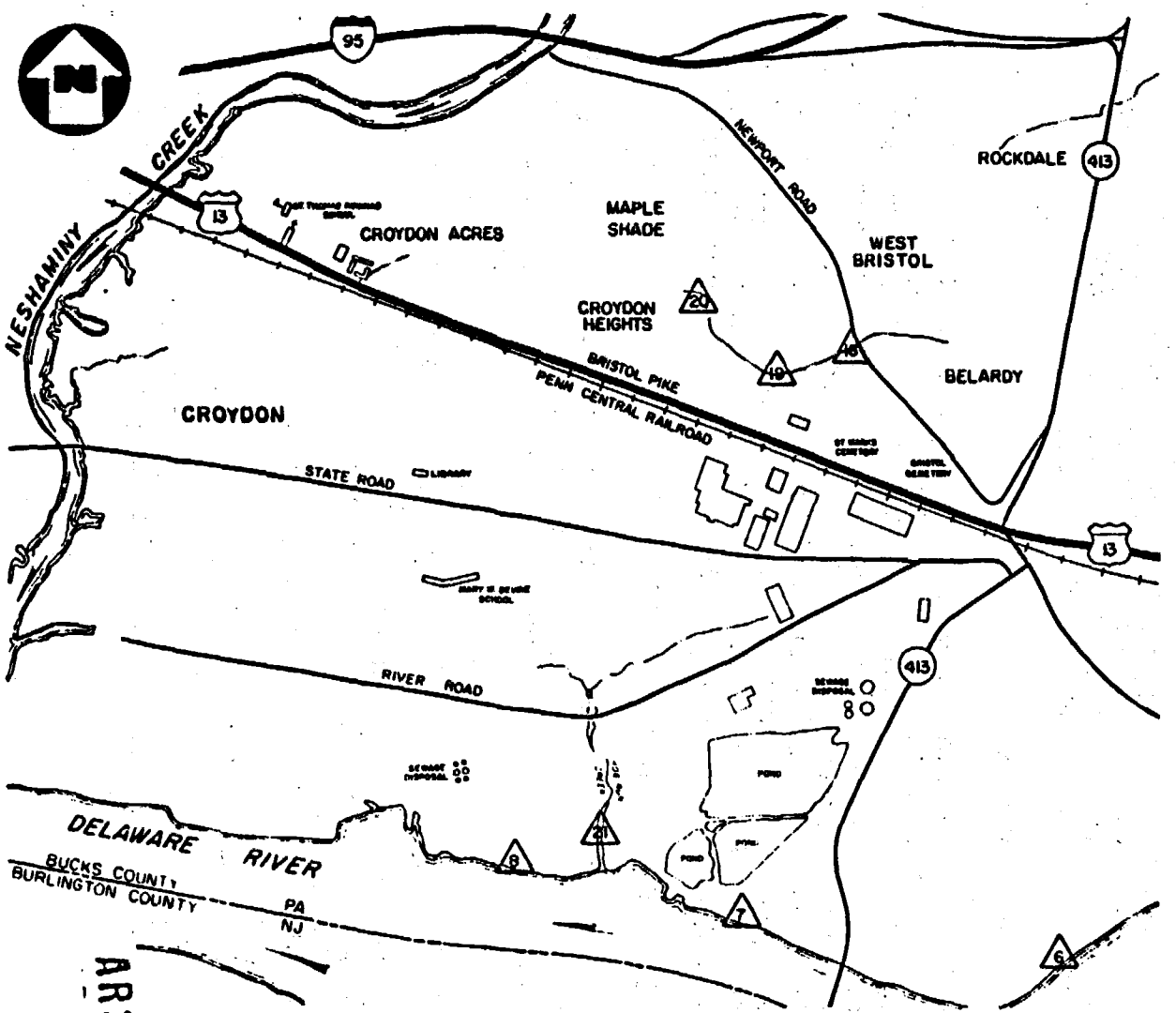
Table 3-2 summarizes the sample analysis for each sample by media for the Phase II RI field activities. The number of samples, including QA/QC samples, is also provided in this table. Samples will be analyzed by either the EPA Contract Laboratory Program or by REM III laboratories. Table 3-2 outlines the bottle requirements, analytical methods, holding times, and preservation requirements. Contract Laboratory Program SAS Request Forms and REM III Team Laboratory Request Forms are provided in Appendices D and E, respectively.

3.4 EQUIPMENT DECONTAMINATION

All nondedicated sampling equipment shall be decontaminated prior to sampling in the field and between each sample. This equipment may include scoop samplers, bailers, and stainless steel spoons.

The decontamination procedures are as follows:

- Potable water rinse.
- Alconox or liquinox detergent wash.
- Potable water rinse.
- Distilled/deionized water rinse.
- Methanol.
- Distilled/deionized water rinse.
- Air dry.
- Wrap small equipment in aluminum foil. Place large equipment (i.e., pump) on clean plastic sheeting.



Station No. *	Description
6	Delaware River - Upstream
7	Delaware River - Adjacent to Rohm and Haas landfill area
8	Delaware River - Downstream from confluence with Hog Run Creek
18	Intermittent stream near Potential Source Area No. 1 (eastern portion)
19	Intermittent stream near Potential Source Area No. 1 (central portion)
20	Intermittent stream near Potential Source Area No. 1 (western portion)
21	Hog Run Creek prior to discharge into the Delaware River

* Station Numbers were not sampled during the Phase I RI due to unanticipated field conditions

△19 Denotes Surface Water and Sediment Sampling Location Number 19

PHASE II SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS
CROYDON TCE SITE, BUCKS COUNTY, PA

FIGURE 3-8

0 700 1400
SCALE IN FEET

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Exceptions include:

- Water level indicators, pH probe, Eh probe, conductivity probe, and submersible pumps. The following decontamination steps will be taken between sample points or measurements:

  - Clean that portion of the equipment which comes into contact with the media by rinsing thoroughly with deionized water.

- Filtering apparatus deconning procedures are as follows:

  - Alconox or Liquinox detergent wash
  - Potable water rinse
  - 10 percent nitric acid rinse
  - Distilled/deionized water rinse

- Split spoons (monitoring well installation only). Because soil samples will not be analyzed for chemical constituents (i.e., visual observation - logging only), the following procedure can be applied:

  - Potable water rinse
  - Steam clean spoons and back end of rig between borings

- Split spoons (soil investigation). Split spoons used to collect soil samples for subsequent chemical analysis shall be deconned using the following procedures:

  - Potable water rinse
  - Alconox or Liquinox detergent wash
  - Potable water rinse
  - Methanol rinse
  - Distilled/deionized water rinse

Personal decontamination procedures are outlined in the Health and Safety Plan (see Section 4.0).

4

4.0 SITE-SPECIFIC HEALTH AND SAFETY PLAN FOR REM III HAZARDOUS WASTE SITE ACTIVITIES

This section contains the Health and Safety Plan (HASP) for the Croydon TCE Site. It is an integral part of the FOP; however, it is designed to function as a stand-alone document as reflected by its internal structure and organization.

SITE-SPECIFIC HEALTH AND SAFETY PLAN FOR REM III
HAZARDOUS WASTE SITE ACTIVITIES

SITE: Croydon TCE Site

LOCATION: Bucks County, Pennsylvania

DATE PREPARED: May 17, 1988

PREPARED BY: K S Brady/NUS Corporation
(NAME/COMPANY)

PLANNED SITE ACTIVITY DATES: August-October, 1988

REVISION: 1

EBASCO SERVICES INCORPORATED, EBASCO SUBCONTRACTORS AND THE UNITED STATES ENVIRONMENTAL PROTECTION AGENCY DO NOT GUARANTEE THE HEALTH OR SAFETY OF ANY PERSON ENTERING THIS SITE. DUE TO THE HAZARDOUS NATURE OF THIS SITE AND THE ACTIVITY OCCURRING THEREON, IT IS NOT POSSIBLE TO DISCOVER, EVALUATE, AND PROVIDE PROTECTION FOR ALL POSSIBLE HAZARDS WHICH MAY BE ENCOUNTERED. STRICT ADHERENCE TO THE HEALTH AND SAFETY GUIDELINES SET FORTH HEREIN WILL REDUCE, BUT NOT ELIMINATE, THE POTENTIAL FOR INJURY AT THIS SITE. THE HEALTH AND SAFETY GUIDELINES IN THIS PLAN WERE PREPARED SPECIFICALLY FOR THIS SITE AND SHOULD NOT BE USED ON ANY OTHER SITE WITHOUT PRIOR RESEARCH AND EVALUATION BY TRAINED HEALTH AND SAFETY SPECIALISTS.

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TABLES

FIGURES

SECTION I: GENERAL

This plan has been prepared in conformance to REM III Program Guideline HS-1.01. It addresses all those activities associated with the Phase II Remedial Investigation/Feasibility Study (RI/FS) at the Croydon TCE Site and will be implemented by the HSO during site work. Compliance with this HASP is required of all persons and third parties who enter this site. Assistance in implementing this Plan can be obtained from the REM III Health and Safety Manager (HSM), and/or the NUS Corporation Company Health and Safety Supervisor (CHSS). The content of this HASP may change or undergo revision based upon additional information made available to health and safety (H&S) personnel, monitoring results or changes in the technical scope of work. Any changes proposed must be reviewed by H&S staff and are subject to approval of the NUS Corporation CHSS, and the HSM.

SITE Croydon TCE Site SITE NO. 621Y

PLAN DATE May 17, 1988

SCOPE OF WORK Mobilization, monitoring well installation, geological investigation, (aquifer testing, water level measurements, et al.), surveying, groundwater, residential well, surface soil, subsurface soil, stream and sediment sampling.

	SITE MANAGER	HEALTH AND SAFETY OFFICER
NAME	Raymond P Wattras	Kathleen S Brady
WORK PHONE	412-788-1080	412-788-1080

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EMERGENCY PHONE NUMBERS

Bristol	Police Dept.	215-785-4040
County Dispatch	Fire Dept.	215-547-5222
County Dispatch	Rescue Service	215-547-5222
Lower Bucks	Hospital	215-785-9400 ER
Delaware Valley	Back-up Hospital	215-750-3260 ER
	National Response Center	800-424-8802
Philadelphia, PA	Poison Control Center	215-386-2100
Matthew M Soltis	CHSS	412-788-1080
	REM III Regional Manager	215-752-0212
S Barnick	Field Operations Leader	412-788-1080
	REM III HSM (J Janous)	703-558-7506
	Community Relations Coordinator	
County Dispatch	Offsite Emergency Services	215-547-5222
	Site Command Post	TBA

Note: 911 is not operational in this area of Pennsylvania. Emergency numbers were obtained by contacting Bristol Police and the County Dispatch Fire/Rescue Service. In the event that fire fighting or ambulance services become necessary, the dispatcher will send the appropriate response unit upon receipt of the NUS work location.

ER - Emergency Room

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SECTION II: HEALTH AND SAFETY PERSONNEL

2.0 HEALTH AND SAFETY PERSONNEL DESIGNATIONS

The following briefly describes the health and safety designations and general responsibilities which may be employed for the Croydon TCE Site. (When preparing plan, delete all personnel not appropriate to this site.)

2.1 COMPANY HEALTH AND SAFETY SUPERVISOR

The CHSS has overall responsibility for development and implementation of this HASP. He also shall approve any changes to this plan due to modification of procedures or newly proposed site activities.

The CHSS will be responsible for the development of new company safety protocols and procedures necessary for field operations and will also be responsible for the resolution of any outstanding safety issues which arise during the conduct of site work. Health and safety-related duties and responsibilities will be assigned only to qualified individuals by the NUS Corporation CHSS. Before personnel may work on site, currentness of acceptable medical examination and acceptability of health and safety training must be approved by the CHSS.

2.2 SITE HEALTH AND SAFETY OFFICER

The HSO will be present on site during the conduct of all Level A, or B, or high-hazard Level C field operations and will be responsible for all health and safety activities and the delegation of duties to the H&S staff in the field. Where the site is identified as low-hazard Level C or Level D, the HSO may direct the site health and safety efforts through an assistant health and safety officer approved by the CHSS. The assistant will be responsible for implementation of the HASP. He may direct or participate in downrange activities as appropriate when this does not interfere with his primary HSO responsibility. The HSO has stop-work authorization which he will execute upon his determination of an imminent safety hazard, emergency situation, or other potentially dangerous situations, such as detrimental weather conditions. Authorization to proceed with work will be issued by the CHSS after such action. The HSO will initiate and execute all contact with support facilities and personnel when this action is appropriate.

2.3 ASSISTANT HEALTH AND SAFETY OFFICER

An Assistant HSO may be designated. On low-hazard Level C or Level D sites he may have collateral duties but must be qualified for the health and safety responsibility by the CHSS. At Level A, B or high-hazard Level C sites, he will be the downrange person who accompanies field sampling teams and will

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report to the HSO. Additionally, he may be required to support the HSO when multiple operations are conducted that require monitoring and HSL surveillance. His primary responsibility is to provide the appropriate monitoring to ensure the safe conduct of field operations. He will have access to continuous communications with the Command Post. The number of Assistant HSO's will be dependent upon the number of downrange operations occurring simultaneously, site level of protection designation, and the individual assignments made by the HSO. The Assistant HSO will also share responsibility with the Field Operations Lead and the HSO for ensuring that all safety practices are utilized by downrange teams and that during emergency situations appropriate procedures are immediately and effectively initiated. He will also be responsible for the control of specific field operations and all related activities such as personnel decontamination, monitoring of worker heat or cold stress, distribution of safety equipment, and conformance with all other procedures established by the HASP.

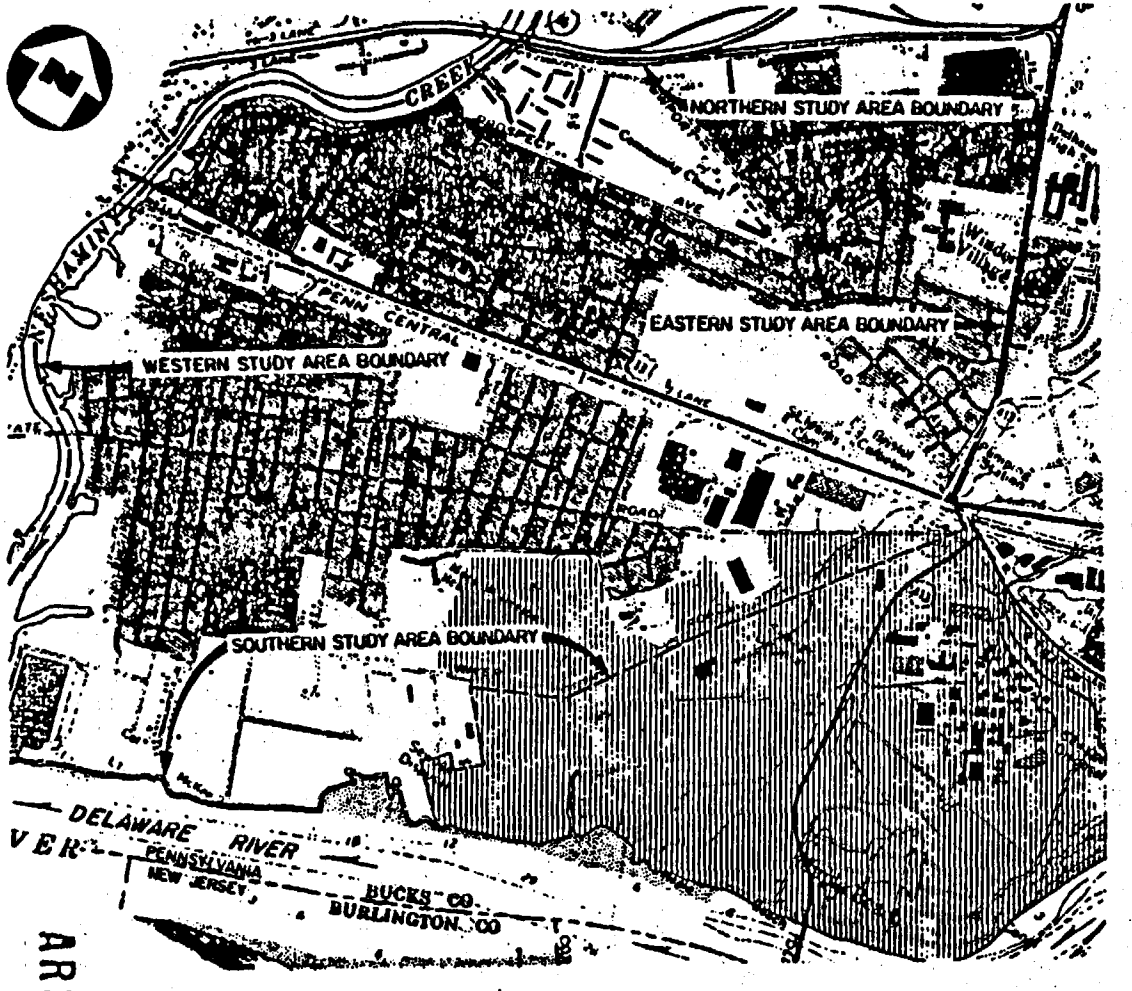
SECTION III: SITE LOCATION, HISTORY, AND PHYSICAL DESCRIPTION

The Croydon TCE Site is located in Bristol Township, Bucks County, Pennsylvania (Figure 1). Sampling of residential wells and surface water in this area detected elevated levels of trichloroethylene (TCE), tetrachloroethylene (PCE), and other organic and inorganic contaminants. The source of this contamination has not yet been defined, and therefore, a site boundary cannot be established. (A review of the Hazard Ranking System reference documents revealed no description of a site boundary or a source of contamination.) However, a boundary for this investigation has been established and will be referred to as the "study area." This area encompasses approximately 4 square miles.

The study area is bordered by Interstate 95 to the north, the Rohm & Haas Company property and the Delaware River to the south, Neshaminy Creek to the west, and Route 413 to the east. The Rohm & Haas Company property contains a landfill which is under investigation by EPA for allegedly contaminating the groundwater south of the study area (i.e., south of River Road). The Croydon TCE Site RI/FS will focus on the area north of the Rohm & Haas property since EPA is currently studying the landfill area. Additionally, evidence suggests that the groundwater contamination in the Croydon community is not the result of the Rohm & Haas landfill site.

The criteria for establishing the study area boundary were based on (1) potential widespread groundwater contamination in this portion of Bristol Township, based on reports by the Rohm & Haas Company, (2) potential source areas identified by the EPA Environmental Photographic Interpretation Center (EPIC), and (3) natural boundaries such as Neshaminy Creek and the Delaware River. Interstate 95 and Route 413, which comprise the northern and eastern borders of the study area, were selected only to limit the study area to a somewhat reasonable size. Based on the finding of this RI/FS, the study area boundaries will be re-evaluated and may expand.

The study area includes a number of residential communities that were constructed mainly in the 1940s-1960s. These communities include Croydon, Croydon Heights, Croydon Acres, Maple Shade, West Bristol, Belardy, and Rockdale. Croydon is the largest of the residential areas and encompasses the area south of U.S. Route 13 and the Delaware River. The remaining residential areas comprise the area north of U.S. Route 13. State Road and River road, which cross through the Croydon area, run parallel with U.S. Route 13 and eventually form a five-way intersection with Routes 413 and 13. This intersection forms the southeastern corner of the study area. Commercial establishments including gas stations, restaurants, dry cleaners, bakeries, and auto repair shops are located along U.S. Route 13 and State Road.



LEGEND

Study Area Boundary

Rohm and Haas Company Property

QUADRANGLE LOCATION

BASE MAP IS AN ENLARGEMENT OF A PORTION OF THE U.S.G.S. BEVERLY, PA-NJ QUADRANGLE (7.5 MINUTE SERIES, 1966, PHOTOREVISED 1973, CONTOUR INTERVAL 20 FEET) AND A PORTION OF THE BRISTOL, PA-NJ QUADRANGLE (7.5 MINUTE SERIES, 1956, PHOTOREVISED 1981, CONTOUR INTERVAL 20 FEET)

0 1000 2000 3000 4000

SCALE IN FEET

FIGURE 1

LOCATION MAP
CROYDON TCE SITE, BUCKS COUNTY, PA

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Population figures were not available for the individual communities. Bristol Borough, of which the study area is only a small part, reported a population of 10,747 (U.S. Census, 1984). Based on a review of tax maps, it is estimated that the population within the study area could range between 2,000 to 3,000 residents. The study area is serviced by the Bristol Borough Water Authority; however, a number of streets are not connected to the municipal water supply. A questionnaire, which was prepared to locate homes without the services of a public water supply, identified a total of 38 residences that depend on groundwater as a source of potable water.

A number of light to heavy industries are located in the southeastern portion of the study area between U.S. Route 13 and State Road. This portion of the study area may be a potential source of the groundwater contamination, based on the EPIC investigation, which identified 13 potential waste sources, and on studies conducted by BMC, Inc. for the Rohm & Haas Company. The potential source areas extend from just north of U.S. Route 13 (Source Area No. 1) to the Rohm & Haas Company's sewage disposal area (Source Area No. 12).

The potential source areas were identified by analysis of historical aerial photographs for the period 1940 to 1978. The source areas were identified as potential threats to the groundwater based on the presence of features or "signatures" associated with different environmental conditions. The "signature" refers to a combination of characteristics (such as color, tone, shadow, texture, and size) which indicate a specific object or condition (USEPA, 1985). These conditions usually referred to such things as excavated areas, standing liquids, mounded materials, stained soils, and storage areas for drums and/or tanks. Many of the 13 potential source areas indicate that no evidence of adverse environmental conditions existed for the latest (1978) aerial photograph. This could be due to any number of reasons. For example, in Potential Source Area No. 4, a pool of dark-toned standing liquid was observed in an excavated area as depicted by an aerial photograph taken in 1970. However, the 1978 photographic analysis found that four industrial buildings have been built over the excavated area, completely covering any signs of this area. Thus, the excavated area was completely filled between 1970 and 1978.

SECTION IV: SITE RELATED INCIDENTS, COMPLAINTS, AND ACTIONS

SITE STATUS

The site was discovered by investigations undertaken by the Rohm & Haas Company, which operated a manufacturing facility near the Croydon community. Rohm & Haas performed a number of environmental investigations to determine the source of TCE contamination in the vicinity of River Road and Hog Run Creek. The presence of TCE in groundwater was believed to be emanating from a landfill which was owned by Rohm & Haas. Through a number of environmental investigations, evidence existed that the source of TCE contamination may be from sources other than the Rohm & Haas Landfill.

In April, 1985, the NUS Corporation Field Investigation Team (FIT) prepared a Hazard Ranking Score (HRS) for the Croydon TCE Site. The HRS was based on the findings of the Rohm & Haas investigations, which included data for groundwater, surface water (Hog Run Creek), and sediments. Because the source of contamination was unknown, a defined site boundary could not be established. In September 1985, the Croydon TCE Site was selected for inclusion on the National Priorities List (NPL) and ranked 616th.

SECTION V: WASTE DESCRIPTION/CHARACTERIZATION

5.1 The following information is presented in order to identify the types of materials that may be encountered at the Croydon TCE Site. The detailed information on these materials was obtained from various sources. Site contaminants and concentrations were obtained by consulting the RI/FS Scoping Meeting Report prepared by NUS Corporation, April 1987. Hazard Rating definitions were determined by consulting the CERCLA reference, SAX, and previous REM III HASPs prepared by NUS. Ratings were prepared for those chemicals on site that were detected with the greatest amount of frequency.

5.2 CERCLA HAZARD RATING DEFINITIONS

Substance	Toxicity	Ignitability	Reactivity	Persistence
Arsenic	2	0	0	2
Cadmium	0	0	0	2
Chloroform	3	0	0	3
Chromium	3	0	1	2
Copper	0	0	0	2
1,2-Dichloroethane	2-3	2-3	2	1
Trans-1,2-Dichloroethene	2	3	2	0
Lead	2	0	0	2
Methylene Chloride	2	1	0	2
Mercury	2-3	0-1	3	2
Nickel	0	0	0	2
Phenols	3	2	0	1
Tetrachloroethene	2	0	0	3
1,1,1-Trichloroethane	2	0	1-2	3
Trichloroethene	2	1	0	1
Zinc	0-1	0-1	0-1	2
Benzene	3	3	0	1
Chlorobenzene	2	3	0	2
1,1-Dichloroethene	2	4	2	0
O-Xylene	2	3	0	1

5.3 WASTE TYPES: Liquid X Solid X Gas
Sludge Semi-solid Other

5.4 CHARACTERISTICS: Corrosive X Flammable X
Explosive Volatile X
Radioactive Inert
Other

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5.5 CONTAINMENT: Pit_____ Pond_____ Lagoon_____
Lake_____ Process Vessel_____
Tank_____ Piping_____ Drum_____
Tank Car_____ Lab Pack____
Other__X__

5.6 DESCRIPTION OF "OTHER" FOUND IN 5.3, 5.4, AND 5.5.

Principally groundwater contamination and surface water contamination is the concern - source unknown.

SECTION VI: HAZARD ASSESSMENT

Based upon existing information it appears that the potential for chemical exposure (from site contamination) for workers is minimal. As depicted in Table 1, basically µg/l concentrations are involved. Some compounds (cadmium and zinc) concentration in groundwater is approximately 1-2 mg/l. This is the greatest concentration of site contamination known to this writer.

Although concentrations of contaminants may be low, it is important for personnel to have a general knowledge of some of the contaminants' properties. Basically, the contaminants in question are essentially organic solvents or metals. In regard to organic solvents, many of the compounds of concern are liquids at normal room temperature and all are colorless when pure. Their toxicity varies from that of simple asphyxiants to moderately high, and their hazards vary over a wide range. Some are known carcinogens (benzene), while others are principally known for narcotic effects. A metal is an element, crystalline when solid, characterized by ductility, opacity, electrical conductivity, and a metallic luster. Like organic solvents, toxicity varies from compound to compound. Some are known carcinogens (hexavalent chromium), others cause mental defects (mercury), while still others present less harmful effects. Consult Section V for hazard information on specific site contaminants.

It should be noted that the Croydon TCE Site is located in an industrialized area. Therefore, unknown exhaust fumes are emitted from various industrial sources, i.e., the previously mentioned facilities in Section III of this HASP. During the site reconnaissance in April 1987, no team member complained of any adverse effects from the odors in the Croydon area. There have been subsequent complaints from other site visitors of headache and nausea after walking through Croydon's industrialized area. It cannot be certain if these symptoms/complaints can be traced to the Croydon TCE Site, but it is important that personnel be aware of the pollution in the area.

Another site concern involves Coyne Chemical. This facility recently burned to the ground. While operating (1984-1987), the facility warehoused, stored, and distributed chemical products and materials. Coyne Chemical dealt with over 200 types of chemicals including solvents such as TCE. As illustrated in Section 8.2.2, the affected fire area may directly influence health and safety concerns.

In accordance with OSHA 1910.120, the following section provides a hazard assessment for the planned activities that are scheduled to take place on the Croydon TCE Site.

TABLE 1

COMPARISON OF EXISTING DATA AND ARARS
CROYDON TCE SITE

Constituent	Maximum Concentration Detected (µg/l)			NPDWR (µg/l)(4)		Health Advisories (µg/l)(4)		AWQC			
								Aquatic Life (µg/l)(5)		Human Health (µg/l)(4)	
	DW (1)(2)	SW (3)	MW (6)(7)(8)	MCLs/ PMCLs	MCLGs/ PMCLGs	Child	Adult	Acute	Chronic	Ingestion of Drinking Water and Aquatic Life	Ingestion of Drinking Water
trichloroethene	30.1	30	522	5(A)	0(B)	-	-	2,000	-	0(2.7)[a]	0(2.8)[a]
tetrachloroethene	3.8	1.8	218	-	0(B)	10 day: 34,000 long term: 1,940	long term: 6,800	5,280	840	0(0.8)	0(0.88)[a]
1,1,1-trichloroethane	10.9	7.3	130	200(A)	200(B)	1 day: 140,000 10 day: 35,000 long term: 35,000	long term: 125,000 lifetime: 1,000	18,000	-	18.4 mg/l	19 mg/l
1,1-dichloroethane	0.9	2.6	0.5	-	-	-	-	-	-	-	-
1,1-dichloroethene	ND	1.1	0.1	7(A)	-	-	-	11,600	-	0(33 ng/l)	0(33 ng/l)
trans-1,2-dichloroethene	6.7	ND	12	-	70(A)	1 day: 2,700 10 day: 1,000 long term: 1,000	long term: 3,500 lifetime: 350	11,600	-	-	-
1-2-dichloroethane	22.5	1.0	ND	5(A)	0(B)	1 day: 740 10 day: 740 long term: 740	long term: 2,600	118,000	20,000	0(9.4)[a]	0(9.4)[a]
chloroform	3.7	<1	10.7	-	-	-	-	28,900	1,240	0(0.19)[a]	0(0.19)[a]

TABLE 1
COMPARISON OF EXISTING DATA AND ARARS
CROYDON TCE SITE
PAGE TWO

Constituent	Maximum Concentration Detected (µg/l)			NPDWR (µg/l)(4)		Health Advisories (µg/l)(4)		AWQC			
								Aquatic Life (µg/l)(5)		Human Health (µg/l)(4)	
	DW (1)(2)	SW (3)	MW (6)(7)(8)	MCLs/ PMCLs	MCLGs/ PMCLGs	Child	Adult	Acute	Chronic	Ingestion of Drinking Water and Aquatic Life	Ingestion of Drinking Water
methylene chloride	5.9	5.9	ND	-	-	1 day: 13,300 10 day: 1,500	-	11,000	-	0(0.19)*	0(0.19)*
vinyl chloride	9.4	ND	ND	1(A)	0(B)	1 day: 2,600 10 day: 2,600 long term: 13	long term: 46	-	-	0(2.0)*	0(2.0)*
benzene	ND	31.2	ND	5(A)	0(B)	1 day: 233 10 day: 233	-	5,300	-	0(0.66)*	0(0.67)*
chlorobenzene	ND	<1	ND	-	-	1 day: 1,800 10 day: 1,800 long term: 9,000	long term: 300,000 lifetime: 3,150	250	50	488	488
cadmium	1,140	NA	NA	10(B)	-	1 day: 43 10 day: 8 long term: 5	long term: 18 lifetime: 18	**	**	10	10
ethylbenzene	ND	374	2.6	-	680(A)	1 day: 21,000 10 day: 2,100	lifetime: 3,400	32,000	-	1,400	2,480
toluene	ND	1.3	5.2	-	2,000(A)	1 day: 18,000 10 day: 6,000	lifetime: 10,800	17,500	-	14,300	15,000

TABLE 1
COMPARISON OF EXISTING DATA AND ARARS
CROYDON TCE SITE
PAGE THREE

Constituent	Maximum Concentration Detected (µg/l)			NPDWR (µg/l)(4)		Health Advisories (µg/l)(4)		AWQC			
								Aquatic Life (µg/l)(5)		Human Health (µg/l)(4)	
	DW (1)(2)	SW (3)	MW (6)(7)(8)	MCLs/ PMCLs	MCLGs/ PMCLGs	Child	Adult	Acute	Chronic	Ingestion of Drinking Water and Aquatic Life	Ingestion of Drinking Water
bis(2-chloreise-propyl)ether	ND	21	ND	-	-	-	-	238,000	-	0(30 ng/l)*	0(30 ng/l)
ethylene dichloride	0.5	ND	ND	-	0(A)	-	-	-	-	-	-
arsenic	25	NA	NA	50(B)	50(A)	1 day: 50 10 day: 150 longer term: 50	longer term: 50 lifetime: 50	440	-	0(2.2 ng/l)*	0(25 ng/l)*
lead	5	NA	NA	50(B)	20(A)	longer term: 20 µg/day	longer term: 20µg/day	**	**	50	50
zinc	1,690	NA	NA	-	-	-	-	47	**	5,000+	5,000+
copper	620	NA	NA	-	1,300(A)	-	-	**	**	1,000+	1,000+
mercury	1.3	NA	NA	2(B)	3(A)	-	lifetime: 5.5	2.4	0.012	144 ng/l	10

ND - Not Detected
(A) - Proposed
(B) - Final
NA - Not Analysed
DW - Domestic Wells
MW - Monitoring Wells
SW - Surface Water
NPDWR - National Primary Drinking Water Regulations
MCLs - Maximum Contaminant Level (µg/l)
PMCL - Proposed MCL
MCLG - Maximum Contaminant Level Goal (µg/l)
PMCLG - Proposed MCLG
AWQC - Ambient Water Quality Criteria (µg/l)

* - AWQC is zero. The value corresponds to a 1×10^{-6} lifetime cancer risk.
** - Criterion dependent on water hardness
+ - Organoleptic (taste and odor) effects

(S) - Sources (1) BCM, 1984a
(2) BCM, 1984b
(3) NUS Corp., 1985
(4) USEPA, 1986a and 1986b
(5) USEPA, 1980
(6) BCM, 1986a
(7) BCM, 1986b
(8) BCM, 1986c

1. Mobilization/Demobilization/Surveying. From a chemical exposure standpoint, these activities present the most minimal risks to workers. There is a possibility that there may be some surface soil contamination on site, but principally a groundwater/surface water problem appears to be the main concern. To combat potential contact with contaminated soil, personnel are required to wear the PPE described in Section 8.2.2 of this HASP.

2. Monitoring Well Installation/Geological Investigations. From a chemical exposure standpoint, these activities present a greater risk factor than those depicted above. Potential contact with contaminated groundwater and possibly contaminated soil, is involved. The chemicals depicted in Section V appear to be the main actors. During these activities, more stringent dermal protection (see Section 8.2.2) will be required. Other hazards associated with drilling operations involve physical hazards, i.e., pinch points, underground/overhead utilities, overhead equipment, and heavy lifting necessary. Also, unauthorized (personnel) site entry is cause for concern. This problem is covered in detail in Section 8.1 of this HASP.

3. Residential Well Sampling. These activities present a minimal risk factor from a chemical exposure standpoint.

4. All Other Sampling. From a chemical exposure standpoint, these activities are second in risk or almost comparable to monitoring well installation.

Personnel are required to follow all PPE requirements, monitoring instrument requirements and S.O.P.s (i.e., no onsite hand to mouth activities, etc.) to counterattack absorption, inhalation, and ingestion possibilities.

SECTION VII: TRAINING

7.0 BASIC TRAINING REQUIRED

Completion of the REM III Fundamental Health and Safety Training or the approved equivalent is required for all employees who will perform work in areas where the potential for a toxic exposure exists. Training or training and site experience must also conform to the requirements of 29 CFR 1910.120.

7.1 ADVANCED TRAINING

Advanced Training as necessary will be provided to any personnel who will be expected to perform site work utilizing Level A protection or other specialized operation to be undertaken at a site. An Emergency Response Team shall be formed and trained to carry out Level A work.

7.2 SITE-SPECIFIC TRAINING

Training will be provided that will specifically address the activities, procedures, monitoring, and equipment for the site operations. It will include site and facility layout, hazards, and emergency services at the site, and will detail all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

7.3 SAFETY BRIEFINGS

Project personnel will be given briefings by the HSO or Assistant HSO on a daily or as-needed basis to further assist site personnel in conducting their activities safely. It will be provided when new operations are to be conducted, changes in work practices must be implemented due to new information made available, or if site or environmental conditions change. Briefings will also be given to facilitate conformance with prescribed safety practices when performance deficiencies are identified during routine daily activities or as a result of safety audits.

7.4 FIRST AID AND CPR

The CHSS will identify those individuals requiring this training in order to ensure emergency treatment is available at field activities. It is expected that the selected number of field workers will have First Aid training and several members of the field team will have CPR training. These courses will be consistent with the requirements of the American Red Cross Association or the American Heart Association.

7.5 OTHER TRAINING

None

SECTION VIII: ZONES, PROTECTION, AND COMMUNICATION

8.1 SITE ZONES

As stated in Section III, the source of site contamination has not yet been defined, and therefore, a site boundary cannot be established. However, a boundary for this investigation has been determined and will be referred to as the study area. This area encompasses approximately 4 square miles.

Various field activities will be taking place at several locations in the study area. Each separate work location will involve a separate site set-up. The Exclusion Zone will be designated as the specific sampling, drilling, or surveying location. Particularly during drilling work, this area will be barricaded by the use of ropes or cones to control pedestrian traffic and the entrance of unauthorized personnel. Each work location will also contain a personnel decontamination station, as part of the contamination reduction corridor. It is expected that the personnel decontamination station will involve minimal set-up, based on the low level of site contamination.

The Support Zone, where the trailer, telephone, and equipment will be stored, will be on a controlled area on the Rohm & Haas property. It is possible that heavy equipment decontamination may also take place in this area. Therefore, due to the existence of various work locations and the possible location of the decontamination pad (for heavy equipment), it may be necessary for personnel to perform personnel decontamination at the work locations, drive to the heavy equipment decontamination area, and re-don minimal personnel protective equipment for steam cleaning purposes. Doffing protective clothing before driving to the heavy equipment decontamination area may be necessary to avoid contaminating the inside of trucks and other vehicles. Re-donning minimal PPE may be necessary to avoid possible contamination during steam cleaning of equipment.

An alternate procedure may involve lining the inside of vehicles with plastic drop cloths before operators drive their work vehicles to the heavy equipment decontamination area. This would control contaminating the inside of vehicles and would also permit all decontamination (including personnel) procedures to take place in one general area.

Once the site HSO observes field activities, a decision will be made in regard to the handling of personnel decontamination.

8.2 PERSONAL PROTECTION

8.2.1 General

The level of protection to be worn by field personnel will be defined and controlled by the HSO with approval of the CHSS. Basic levels of protection for general operations are outlined in the REM III Personal Protection Guidelines HS-2. Where more than one hazard area is indicated, further definition shall be provided by review of site hazards, conditions, and proposed operational requirements and by monitoring at the particular operation being conducted. Protection may be upgraded or downgraded, as appropriate, only after the HSO receives authorization from the NUS Corporation CHSS.

Task	Level of Protection
Site Mobilization	D
Monitoring Well Installation	D
Geological Investigations	D
All Sampling Activities	D
Demobilization	D

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8.2.2 Initial Levels of Protection

Initial levels of protection will be employed during the performance of the Initial Reconnaissance. The reconnaissance team is anticipated to consist of a minimum number of personnel. The HSO, the Site Manager, or Site Project Engineer, and other appropriate support personnel may be required. The team will enter hazardous areas and spill locations in conservatively-specified protection with appropriate monitoring equipment. The Initial Reconnaissance will allow for the selection of appropriate protection levels for planned operations, decontamination procedures, site layout, sampling strategies, and general safety planning. It should be noted that this HASP allows for upgrading or downgrading of protection levels to conservatively preclude any potential for contamination while not sacrificing protection or efficiency. During the Initial Reconnaissance, the team will perform various monitoring techniques to identify the presence of contaminants as well as assessing the integrity of the site in consideration of safety for the proposed site investigation, sampling, or construction operations. Careful attention shall be paid to conform to requirements of 29 CFR 1910.120(c) relating to Site Characterization and Analysis.

(Planned Protection and Justification)

Mobilization	Level D	Standard field clothes,* steel toe/shank shoes or boots.
Monitoring Well Installation	Level D	Standard field clothes,* steel toe/shank shoes or boots. Boot covers, Tyvek coveralls, surgeons and nitrile gloves, hard hat, safety glasses with side shields, earplugs optional.
Geological Investigations	Level D	Standard field clothes,* steel toe/shank shoes or boots. Boot covers, Tyvek coveralls, surgeons and nitrile gloves, hard hat, safety glasses with side shields, earplugs optional.
Surveying	Level D	Standard field clothes,* steel toe/shank shoes or boots, work gloves.
Residential Well Sampling	Level D	Standard field clothes,* steel toe/shank shoes or boots. Nitrile gloves and safety glasses with side shields when handling preservatives.

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All Other Sampling	Level D	Standard field clothes,* steel toe/shank shoes or boots, boot covers, Tyvek coveralls, surgeons and nitrile gloves, safety glasses with side shields, hard hat when in vicinity of drill rig or other overhead equipment.
Demobilization	Level D	Standard field clothes,* steel toe/shank shoes or boots.

* Standard Field Clothes = Long-sleeved shirt, long pants.

Note: All NUS personnel are required to wear TLD badges during field operations.

The planned protection for the aforementioned activities is based on the available site information, which generally involves low level contamination. Even though the anticipated exposure levels are low, Tyvek coveralls will be worn during certain field activities to counterattack skin/clothing contamination and subsequent cross-contamination during home laundering. PE or PVC Tyvek coveralls may also be used during wet conditions, (i.e., rainy conditions, stream sampling).

Note that it is anticipated that all field activities will involve Level D protection. One area where an upgrading in protection may come into play is the Coyne Chemical property, previously mentioned in Section VI of this HASP. It is not known how, or if, the planned work area near the Coyne property has been affected by the fire, but it is anticipated that more information will be gained once the burned area is observed. If deemed necessary by the HSO, a soil sample from the Coyne Chemical area may be screened with the mobile laboratory G.C. before activities commence to determine any effects on the planned personnel protection.

As indicated in Section IX of this HASP, monitoring instruments will be used on site. If elevated readings are encountered the previously mentioned mobile laboratory can be used in attempts to characterize contamination. Characterization can aid in determining the appropriate protection.

8.2.3 Safety Equipment

Basic emergency and first aid equipment will be available at the Support Zone and/or the CRC, as appropriate. This shall include HASP-specified communications, first aid kit, emergency eyewash or emergency shower or drench system, fire extinguisher, and other safety-related equipment. Also located in the Support Zone or the CRZ will be a backup field team when required to support downrange field teams. The Command Post will be manned during all times when teams are downrange, communications will be maintained, and personnel will be available to assist in decontamination procedures for personnel and equipment. Other safety equipment will be located at the site of specific operations, e.g., a drilling rig, as appropriate.

Decontamination equipment, i.e., plastic, brushes, tubs, water, and alconox will be necessary for personnel decontamination stations.

8.3 COMMUNICATIONS

- Walkie-Talkies - Hand held units shall be utilized as much as possible by field teams for communication between downrange operations and the Command Post base-station.

- Telephones - A telephone may be located in the Command Post trailer in the Support Zone for communication with emergency support services/facilities. If not appropriate for a particular project, the nearest public phones shall be identified.

- Air Horns - These will be carried by downrange field teams and also will be maintained at the Support Zone for announcing emergency evacuation procedures (see Section XIV) and backup for other forms of communications.

- Hand signals - To be employed by downrange field teams along with utilizing the buddy system. These signals are also very important when working with heavy equipment. They shall be known by the entire field team before operations commence and covered during site-specific training.

Other communications include: none.

SECTION IX: MONITORING PROCEDURES

9.1 MONITORING DURING SITE OPERATIONS

All site environmental monitoring should be accompanied by meteorological monitoring of appropriate climatic conditions.

9.1.1 Drilling Operations - Monitoring will be performed continuously by the HSO during the conduct of work. A photoionization detector (PID) and/or flame ionization detector (FID) equipped organic vapor meter will be utilized to monitor the breathing zone, the borehole, and all geological samples upon their retrieval. Drill cuttings will also be monitored. A combustible gas indicator (CGI) with oxygen alarm will be used to monitor the borehole for the presence of combustible gases. Similar monitoring of any fluids produced during well development will also be conducted.

9.1.2 Excavation Operations - Monitoring will be performed continuously during all excavation and sampling operations. A PID and/or FID organic vapor meter will be utilized to monitor the breathing zone, the excavated area, any any material taken from an excavation. Monitoring of the excavation with a CGI and oxygen meter will be conducted.

9.1.3 Other Operations - Initial drilling operations should indicate the need for monitoring instruments on certain subsequent activities, and this will be addressed in revisions to this HASP.

9.2 PERSONNEL MONITORING PROCEDURES

During the conduct of site operations, personnel monitoring may be performed to establish and document the environment in which field teams have been working. This monitoring will be utilized to comply with the requirements of the REM III Health and Safety Program and with OSHA regulations. Use of cartridge respirators shall be monitored to comply with OSHA and to document compliance with acceptable exposure criteria.

(Planned personnel monitoring) At this time there are no plans to perform personnel sampling, i.e., use of Gillian pumps on field workers. However, use of monitoring instruments (HNU or OVA, and LEL/O_2 meter) will occur as per Sections 9.1.1-9.1.3 of this HASP. If elevated breathing zone readings occur with the HNU or OVA, attempts at contaminant characterization and quantification will take place via use of the mobile laboratory GC Cartridge respirators can only be used in situations where the site HSO evaluates G.C. data and permits the use of this equipment. In some cases (i.e.: no cartridge available for a certain contaminant), a Level B work situation may be necessary. Finally, it should be noted that the HSO may require the use of cartridge respirators in dusty conditions.

For interpreting LEL/O_2 meter readings, the following action levels shall apply: 10 percent LEL - use spark-proof tools and equipment, proceed with caution; 20 percent LEL - vacate work area. Always stop working in the affected area and contact Pittsburgh Health and Safety when any LEL/O_2 meter reading exceeds 20 percent LEL or when any HNU or OVA reading exceeds background in the breathing zone.

9.3 MEDICAL SURVEILLANCE PROCEDURES FOR EVIDENCE OF PERSONAL EXPOSURE

All REM III personnel and subcontractors who will be performing field work at the Croydon TCE Site will be required to have passed a REM III's medical surveillance examination or equivalent. A release for work will be confirmed by the NUS Corporation CHSS before an employee can begin hazardous activities. The exam will be taken annually at a minimum and upon termination of REM III work. Additional medical testing may be required by the NUS Corporation CHSS in consultation with the company physician and the HSO is an overt exposure or accident occurs, or if other site conditions warrant further medical surveillance. The specific tests that will be employed for a specific site are to be addressed here.

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SECTION X: SAFETY CONSIDERATIONS FOR SITE OPERATIONS

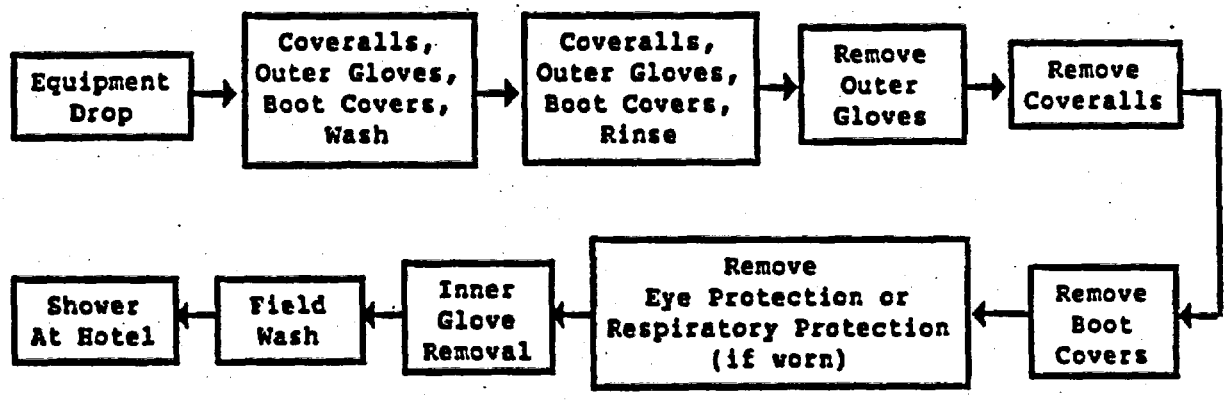
10.1 GENERAL

All field sampling will be performed under the level of protection described in Section VIII. In this section all non-monitoring, safety-related procedures will be described for each site operation. Such procedures may include special additional clothing to be worn, respirator specifications and modification, special safety equipment such as harnesses and non-sparking tools, need for backup teams, etc. Special considerations should also address provision for heat and cold stress, presence of water, sewer and electrical lines or underground conduits, sampling handling requirements, etc. (See discussion in HS-1.01)

- All drilling/excavating requires a check (plus documentation) for underground utilities.
- No drilling within a 20 foot radius of overhead power lines.
- No hand-to-mouth contact permitted during site activities.
- No facial hair, which interferes with mask fit, is allowed on personnel required to wear respiratory protection.
- No flames or open fires will be permitted on site.
- No working outdoors will be permitted during electrical storms or high winds.
- Lifelines will be worn when sampling stream/sediment if stream depth exceeds approximately 3.5-4.0 feet.
- Subcontractor personnel will be responsible for employing safe operating procedures and complying with OSHA while drilling and conducting related field efforts.
- All REM III Health and Safety requirements plus the contents of this HASP must be followed by all applicable site workers.
- Work areas must be barricaded by the use of cones or rope to combat unauthorized entry of non-project personnel.

SECTION XI: DECONTAMINATION PROCEDURES

All personnel and equipment exiting the exclusion zone shall be thoroughly decontaminated. Figures should be used to illustrate the decon procedures for personnel and portable equipment for the various protection levels indicated in Section VIII. Heavy equipment, if utilized for operations where it may be contaminated, will have prescribed decontamination procedures to prevent hazardous materials from leaving the site. They may include excavating a shallow pit to collect waste cleaning solution and screens, set up if required, to prevent the spread of air contaminants. The pit will be cleaned, wastes disposed of, filled in, and covered with clean soil when its use is terminated. The surface area of the pit shall be sufficient to accommodate the washwater generated by the largest piece of machinery. Equipment needed may include a stream generator with high pressure water, empty containers, screens, screen support structures, and shovels.



1. Equipment drop.
2. Wash coveralls, gloves, boot covers with alconox and water.
3. Rinse coveralls, gloves, boot covers with water.
4. Remove outer gloves.
5. Remove coverall by rolling down.
6. Remove boot covers.
7. Remove eye protection, if worn.
8. Remove respiratory protection, if worn.
9. Remove inner gloves (dispose).
10. Wash hands and arms thoroughly in a clean area as soon as possible and before eating or drinking.
11. A total body wash should be performed as soon as possible after leaving the site for the day.

SECTION XII: ADDITIONAL WORK PRACTICES

Specific concerns for each individual site task are included here.

Included throughout text of HASP.

SECTION XIII: DISPOSAL PROCEDURES

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left onsite. All potentially contaminated materials, e.g., clothing, gloves, etc., will be bagged or drummed as necessary and segregated for disposal. All contaminated waste materials shall be disposed of as required by the provisions included in the contract and consistent with REM III and regulatory provisions. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic wastes. Disposal procedures shall be in accordance with the Field Operations Plan.

SECTION XIV: EMERGENCY PLAN

14.0 As a result of the hazards on site, and the conditions under which operations are conducted, the possibility of an emergency situation developing exists. An emergency plan is required to be available for use at all REM III Sites.

Various individual site characteristics will determine preliminary action to be taken to assure that this emergency plan may be successfully implemented in the event of a site emergency. Careful consideration must be given to the proximity of neighborhood housing or places of employment and to the relative possibility of site fire, explosion or release of vapors or gases which will impinge on these neighbors. If there is even a remote possibility of any of these occurrences, the Site Manager must coordinate the neighborhood interface with his Regional Manager, the Community Relations Coordinator, the CHSS and the HSM.

Careful evaluation of the above factors have been made by the Site Manager. Based on this analysis, the following action will be taken prior to site activity.

Evacuation routes for site personnel to follow, and congregation areas in safe places of refuse, shall be designated and communicated to all site personnel. Emergency communication means shall also be designated and communicated. Applicable response agencies shall be notified of the initiation of site activities.

14.1 THE SITE EMERGENCY COORDINATOR IS:

Field Operations Leader	S Barnick
HSO (Alternate)	K S Brady (D Spencer)

The emergency coordinator shall make contact with local fire, police and other emergency units prior to beginning work on site. In these contacts the emergency coordinator will inform the emergency units about the nature and duration of work expected on the site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants. Also at the time the emergency coordinator and the emergency response units shall make arrangements to handle any emergencies that might be anticipated.

Contacts have been (will be) made with the following individuals:

Name	Title	Jurisdiction
	Bristol Police	Croydon Area
	County Dispatch	Fire/Ambulance/Rescue in Croydon and surrounding areas.
	Lower Bucks (Emergency Room) Hospital	Croydon and surrounding areas.

The emergency coordinator shall implement the contingency plan whenever conditions at the site warrant such action. The coordinator will be responsible for assuring the evacuation, emergency treatment, emergency transport of site personnel as necessary, and notification of emergency response units and the appropriate Management staff.

14.2 EVACUATION

In the event of an emergency situation, such as fire, explosion, significant release of toxic gases, etc.; an air horn or other appropriate device will be sounded for approximately 10 seconds indicating the initiation of evacuation procedures. All personnel in both the restricted and nonrestricted areas will evacuate and assemble near the Support Zone or other safe area as identified by the emergency plan. The location shall be upwind of the site as determined by the wind direction indicator. For efficient and safe site evacuation and assessment of the emergency situation, the Emergency Coordinator will have authority to initiate proper action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The HSO or Assistant HSO must see that access for emergency equipment is provided and that all combustion apparatus has been shut down once the alarm has been sounded. Once the safety of all personnel is established the nearest Fire Department and other emergency response groups will be notified by telephone of the emergency. The Site evacuation plan shall be rehearsed regularly as part of the overall training program for site operations.

14.3 POTENTIAL OR ACTUAL FIRE OR EXPLOSION

Immediate evacuation of site (air horn will sound for 10 second intervals) notify local fire and police department, and other appropriate emergency response groups if LEL values are above 25 percent in the work zone or if an actual fire or explosion has taken place.

Fire Department - 215-547-5222
Police Department - 215-785-4040

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14.4 ENVIRONMENTAL INCIDENT (RELEASE OR SPREAD OF CONTAMINATION)

Control or stop spread of contamination if possible. The emergency coordinator should instruct a person on site to immediately contact local authorities to inform them of the possible or immediate need for neighborhood evacuation. If a significant release has occurred, the National Response Center should then be contacted. This group will alter National or Regional Response Teams as necessary. Following these emergency calls, the reporting individual should then notify the SM, CHSS, RM, and HSM.

		PHONE
County Dispatch	Fire Department	215-547-5222
Bristol	Police Department	215-785-4040
	National Response Center	800-424-8802
R P Wattras	SM	412-788-1080
M M Soltis	CHSS	412-788-1080
R C Evans	RM	215-752-0212
G F Smith	HSM	703-558-7506

14.5 PERSONNEL INJURY

Emergency first aid shall be applied onsite as deemed necessary. Then decontamination and transport the individual to nearest medical facility if needed. The HSO will supply medical data sheets to appropriate medical personnel and complete the incident report designated in HS-1.12.

Hospital	-	Lower Bucks County 215-785-9400
Rescue	-	County Dispatch 215-547-5222

The ambulance/rescue squad shall be contacted for transport as necessary in an emergency. However, since some situations may require transport of an injured party by other means, a hospital route must be firmly identified. During the initial reconnaissance a primary hospital and back-up facility shall be located and route located to and from site with details of the route delineated. A hospital route location map shall be conspicuously posted on site.

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Primary Hospital Route:

- Take Route 13 North (how to get to Route 13 depends on specific work area).
- Stay in right lane.
- Turn right at Route 13 and Bath Road.
- Diner will be on the right.
- Take jug handle around the diner and cross over Route 13.
- Stay right on Bath Road.
- Go 1/4 mile.
- Hospital is on the left.

The primary hospital is Lower Bucks County.

Backup Hospital Route:

- Take Route 13 North to 413 West (how to get to Route 13 depends upon specific work area).
- Make a left on 413 to Route 1.
- At Route 1 make a right turn.
- Go through 5 lights, at 6th light make a left.
- At first traffic light, make a right. Will see hospital.

The back-up hospital is Delaware Valley Medical Center.

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14.6 OVERT PERSONNEL EXPOSURE

Include generic first air procedures in this section. Typical response includes:

Skin Contact:	Use copious amounts of soap and water. Wash/rinse affected area thoroughly, then provide appropriate medical attention. Eyewash and emergency shower or drench system will be provided onsite at the CRZ and/or Support Zone as appropriate. Eyes should be rinsed for 15 minutes upon chemical contamination.
Inhalation:	Move to fresh air and/or, if necessary decon/transport to hospital.
Ingestion:	Decontamination and transport to emergency medical facility.
Puncture wound or laceration:	Decontaminate and transport to emergency medical facility. HSO will provide medical data sheets to medical personnel as requested (see Section XVI).

Hospital - Lower Bucks County 215-785-9400
Rescue - County Dispatch 215-547-5222

14.7 ADVERSE WEATHER CONDITIONS

In the event of adverse weather conditions, the HSO will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries
- Potential for cold stress and cold-related injuries
- Treacherous weather-related working conditions
- Limited visibility
- Potential for electrical storms

SECTION XV: AUTHORIZATIONS

Personnel authorized to enter the Croydon TCE Site while operations are being conducted must be certified by the NUS Corporation CHSS. Authorization will involve completion of appropriate training courses and medical examination requirements as required by OSHA 29 CFR 1910.10 and review and sign-off of this HASP. All personnel must utilize the buddy system or trained escort, and check in with the Field Team Leader at the Command Post.

1. NUS Corporation Personnel Authorized to Perform Work Onsite:

1.	All Earth Science Staff	11.	
2.	Surveyors	12.	
3.	Site Manager	13.	
4.	Site Chemist	14.	
5.	Site Engineer	15.	
6.		16.	
7.		17.	
8.		18.	
9.		19.	
10.		20.	

2. Other Personnel Authorized to Enter Site:

1.	ZPMO Personnel	7.	
2.	REM III Regional Personnel	8.	
		9.	
3.	EPA Personnel	10.	
4.	State Environmental Personnel	11.	
5.	Police, Fire, Emergency Personnel		
6.	ICF Personnel		

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SECTION XVI: MEDICAL DATA SHEET

This brief Medical Data Sheet will be completed by all onsite personnel and will be kept in the Command Post during the conduct of site operations. Completion is required in addition to compliance with the Medical Surveillance Program requirements described in the REM III Program Health and Safety Plan. This data sheet will accompany any personnel when medical assistance is needed or if transport to hospital facilities is required.

Project _____

Name _____ Home Telephone _____

Address _____

Age _____ Height _____ Weight _____

Name of Next of Kin _____

Drug or other Allergies _____

Particular Sensitivities _____

Do you wear contacts? _____

Provide a checklist of Previous Illnesses or Exposures to Hazardous Chemicals _____

_____

_____

What medications are you presently using? _____

_____

_____

Do you have any medical restrictions? _____

_____

Name, Address, and phone number of personal physician:

_____

_____

_____

_____

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SECTION XVII: FIELD TEAM REVIEW

Each field team member shall sign this section after site-specific training is completed and before being permitted to work on site.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provisions contained herein.

Site/Project: _____

Name Printed	Signature	Date

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SECTION XVIII: APPROVALS

By their signature the undersigned certify that this HASP is approved and will be utilized at the Croydon TCE Site.

KS Rudyfor David W Spencer
Health and Safety Officer — 6/2/88 Date

Raymond P Walton
Site Manager — 6/2/88 Date

Matthew M. Soltis
Company Health and Safety Supervisor — 6/2/88 Date

for L. Johnson
Company Designated Lead — 6/2/88 Date

Richard C Gelak for J.A. JANNUS
REM III Health and Safety Manager — 06/02/88 Date

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EPA REGION III
SUPERFUND DOCUMENT MANAGEMENT SYSTEM

DOC ID # 110943
PAGE # AR 301160

IMAGERY COVER SHEET
UNSCANNABLE ITEM

Contact the CERCLA Records Center to view this document.

SITE NAME Croydon TCE

OPERABLE UNIT OU1

SECTION/BOX/FOLDER Administrative Record - Section Volume III B - Filecom

REPORT OR DOCUMENT TITLE Final Phase II Field Operations Plan Vol I of II

DATE OF DOCUMENT 5/88

DESCRIPTION OF IMAGERY Phase II Monitoring Well Sampling Locations

NUMBER AND TYPE OF IMAGERY ITEM(S) 1 Oversized Map